OPERATION MANUAL

ATC-1400

TRANSPONDER/DME TEST SET

WARNING:

HIGH VOLTAGE EQUIPMENT

THIS EQUIPMENT CONTAINS CERTAIN CIRCUITS AND/OR COMPONENTS OF EXTREMELY HIGH VOLTAGE POTENTIALS, CAPABLE OF CAUSING SERIOUS BODILY INJURY OR DEATH. WHEN PERFORMING ANY OF THE PROCEDURES CONTAINED IN THIS MANUAL, HEED ALL APPLICABLE SAFETY PRECAUTIONS.

RESCUE OF SHOCK VICTIMS

1. DO NOT ATTEMPT TO PULL OR GRAB THE VICTIM
2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER.
3. IF YOU CANNOT TURN OFF ELECTRICAL POWER, PUSH, PULL OR LIFT THE VICTIM TO SAFETY USING A WOODEN POLE, A ROPE OR SOME OTHER DRY INSULATING MATERIAL.

FIRST AID

1. AS SOON AS VICTIM IS FREE OF CONTACT WITH SOURCE OF ELECTRICAL SHOCK, MOVE VICTIM A SHORT DISTANCE AWAY FROM SHOCK HAZARD.
2. SEND FOR DOCTOR AND/OR AMBULANCE.
3. KEEP VICTIM WARM, QUIET AND FLAT ON HIS/HER BACK.
4. IF BREATHING HAS STOPPED, ADMINISTER ARTIFICAL RESUSCITATION. STOP ALL SERIOUS BLEEDING.

CAUTION

- INTEGRATED CIRCUITS AND SOLID STATE DEVICES SUCH AS MOS FET'S, ESPECIALLY CMOS TYPES, ARE SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGES RECEIVED FROM IMPROPER HANDLING, THE USE OF UNGROUNDED TOOLS, AND IMPROPER STORAGE AND PACKAGING. ANY MAINTENANCE TO THIS UNIT MUST BE PERFORMED WITH THE FOLLOWING PRECAUTIONS:

  1. BEFORE USING IN A CIRCUIT, KEEP ALL LEADS SHORTED TOGETHER EITHER BY THE USE OF VENDOR-SUPPLIED SHORTING SPRINGS OR BY INSERTING LEADS INTO A CONDUCTIVE MATERIAL.

  2. WHEN REMOVING DEVICES FROM THEIR CONTAINERS, GROUND THE HAND BEING USED WITH A CONDUCTIVE WRISTBAND.

  3. TIPS OF SOLDERING IRONS AND/OR ANY TOOLS USED MUST BE GROUNDED.

  4. DEVICES MUST NEVER BE INSERTED INTO NOR REMOVED FROM CIRCUITS WITH POWER ON.

  5. PC BOARD, WHEN TAKEN OUT OF THE SET, MUST BE LAID ON A GROUNDED CONDUCTIVE MAT OR STORED IN A CONDUCTIVE STORAGE BAG.

NOTE

Remove any built-in power source, such as a battery, before laying PC Boards on conductive mat or storing in conductive bag.

  6. PC BOARDS, IF BEING SHIPPED TO THE FACTORY FOR REPAIR, MUST BE PACKAGED IN A CONDUCTIVE BAG AND PLACED IN A WELL-CUSHIONED SHIPPING BOX.

- THE USE OF SIGNAL GENERATORS FOR MAINTENANCE AND OTHER ACTIVITIES CAN BE A SOURCE OF ELECTROMAGNETIC INTERFERENCE TO AVIATION RECEIVERS, WHICH CAN CAUSE DISRUPTION AND INTERFERENCE TO AERONAUTICAL SERVICE OUT TO A DISTANCE OF SEVERAL MILES.

- USERS OF THIS EQUIPMENT SHOULD SCRUTINIZE ANY OPERATION WHICH RESULTS IN RADIATION OF A SIGNAL (DIRECTLY OR INDIRECTLY) AND ENSURE COMPLIANCE WITH INSTRUCTIONS OUTLINED IN FAA CIRCULAR AC 170-6C, DATED FEBRUARY 19, 1981.

ATTENTION

ALL REFERENCES TO THE ATC-1400

ARE VALID FOR THE ATC-1400A

1002-3001-000

ATTENTION

ALL REFERENCES TO THE ATC-1400

ARE VALID FOR THE ATC-1400A

LIST OF EFFECTIVE PAGES

The manual pages listed below which are affected by a current change or revision, are so identified by a revision number and an asterisk.

Date of issue for original and changed pages are:

Original ..... 0 ..... July 1, 1987

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Warning Page	0	4-54b Blank	0
Caution Page	0	4-55 thru 4-90	0
Attention Page	0	A-1 thru A-8	0
A	0	B-1	0
B Blank	0	B-2 Blank	0
i thru x	0	C-1 thru C-7	0
1-1 thru 1-5	0	C-8 Blank	0
1-6 Blank	0	D-1	0
2-1 thru 2-7	0	D-2 Blank	0
2-8 Blank	0	E-1 thru E-37	0
2-9	0	E-38 Blank	0
2-10 Blank	0	F-1 thru F-3	0
2-11	0	F-4 Blank	0
2-12 Blank	0	G-1 thru G-5	0
3-1 Blank	0	G-6 Blank	0
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PREFACE

SCOPE:

This manual contains instructions for operating the ATC-1400 for testing and calibrating DME (Distance Measurement Equipment), ATC (Air Traffic Control) Transponder aircraft equipment and ARINC 568 digital DME indicators. It is strongly recommended that operator be thoroughly familiar with Sections 1 through 3 of this manual before attempting to perform any operating procedures contained in Section 4.

ORGANIZATION:

The operation manual is divided into the following major sections:

SECTION 1 - INTRODUCTION
Provides a brief introduction to the ATC-1400 including purpose, functional capabilities and uses.

SECTION 2 - INSTALLATION
Provides procedures for setting up the ATC-1400 for testing DME and Transponder equipment; also provides instructions for interfacing the ATC-1400 Test Set to ARINC 568 Interrogators and indicators.

SECTION 3 - DESCRIPTION OF CONTROLS, CONNECTORS & INDICATORS
Identifies and functionally describes all ATC-1400 Controls, Connectors and Indicators.

NOTE

- As an operating aid, Figure 3-1 (which locates and identifies all ATC-1400 front panel controls) has been incorporated into a fold-out page. By extending fold-out page, the operator can easily reference any front panel control while simultaneously performing any operating procedure contained elsewhere in this manual.

SECTION 4 - OPERATION
Contains a selection of example operating procedures for testing transponder and DME equipment in local control (front panel) operation, as well as the ASCII commands for remote communication with the ATC-1400 by use of the General Purpose Interface Bus (GPIB), along with an example of remote control test procedures.

Useful supplementary information relating to the operation of the ATC-1400 is contained in appendices at rear of manual. (See Table of Contents for detailed list of manual contents).

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SECTION 1 - INTRODUCTION

1-1 GENERAL

The ATC-1400 is a microprocessor-based test set designed for testing and calibrating DME (Distance Measuring Equipment), ATC (Air Traffic Control) Transponder aircraft equipment, and ARINC 568 Digital DME Indicators. It can be operated manually using front panel controls and switches, or remotely by ATE (Automatic Test Equipment) control through the GPIB (General Purpose Interface Bus).

All necessary test signals and their variations are generated within the test set. Only an oscilloscope is required as peripheral equipment.

1-2 FUNCTIONAL CAPABILITIES

The ATC-1400 incorporates the following features and capabilities:

1-2-1 SIGNAL GENERATOR

1. Frequency Select Modes: Desired L-Band Output Frequency can be selected by direct MHz, VOR-paired, and TACAN channel designation. The desired frequency is selected in 1 MHz increments from 962 MHz to 1213 MHz.

2. ΔF Capability: The desired frequency can be varied ±9.99 MHz in 10 kHz increments.

3. Manual or Automatic Stepping: The selected frequency can be varied manually in 1 MHz steps or automatically in 1 MHz steps, upward in frequency, at a rate determined by a front panel control.

4. Suppressor On/Off: The mutual suppression output can be switched ON or OFF. Suppression pulse level is adjustable on front panel.

1-2-2 DME MODE

Functional block diagram shown on Figure 1-1, page 1-4, depicts the standard test configuration for testing the ARINC 568 DME in local or remote control mode of operation.

1. Range Delay: Switch selectable -1 nmi Range for indicator calibration. When selecting -1 nmi feature, 1 nmi is subtracted from the programmable range of 0 to 399.99 nmi. Actual range of UUT is displayed on DISPLAY SELECT Readout (43), not selected range.

2. Velocity: Selected as inbound or outbound. Inbound velocity decrements selected range to zero and then increments range to 400.00 nmi. Outbound velocity increments selected range to 400.00 nmi, then decrements to zero nmi.

3. Acceleration: Non-zero acceleration decrements selected velocity to 0 then increments to 4000 KTs.

4. Squitter: Squitter is digitally implemented to provide stable rate and distribution, as well as repeatability.

5. TACAN Simulation: When TACAN is selected, ouput pulses are AM modulated with 15 and 135 Hz signals. TACAN main burst and auxiliary burst signals are generated representing a bearing of 180°. External AM and pulse modulation inputs are available on the rear panel.

6. Echo Pulses: When selected, ECHO replies are generated at approximately 30 nmi in response to all interrogations.

7. Pulse Characteristics: DME pulses are formed by filtering and not by pin diode switching; this results in better representation of a gaussian shaped pulse. Pulse spectrum has adequate side lobe shaping to allow adjacent channel rejection measurements.

8. DME Serial Data Interface: The serial BCD distance word is generated by the test set to correspond to range distance programmed in the test set. This serial BCD word is available at the rear panel through a 25 pin D type connector. This interface is designed to be compatible with ARINC Characteristic 568 requirements for digital signals.

   In addition, there is an input on the back panel of the test set to receive the serial BCD distance data from the DME UUT and be displayed on DISPLAY FUNCTION Readout (43).

9. Frequency Channeling Outputs: 2-out-of-5 VOR Paired Channel Frequency is available on the rear panel for control of DME UUT when test set is in automatic frequency stepping mode.

1-2-3 TRANSPONDER MODE

Functional block diagram shown on Figure 1-2, page 1-5, depicts the standard test configuration for testing the ARINC 572 Transponder in local or remote control mode of operation.

1. Modes: Modes 1, 2, T, A, B, C, D, AC_1, and AC_2 are available. Mode AC_1 and AC_2 alternate between Modes A and C. AC_1 will result in XPDR Code data in 4 digit Octal Code for Mode A response to be displayed. AC_2 Mode will have altitude data from Mode C response displayed in feet (X1000).

2. Variable Pulse Spacing: The P_2 and P_3 pulse can be varied in the plus or minus direction or may be selected to the calibrated spacing by individual switches. P_2 and P_3 can not be varied simultaneously at different amounts, as there is a single selector for deviation.

3. Pulse Width: Pulse width generated in transponder mode can be varied from .2 µs to 1.95 µs, or selected for a calibrated width.

4. Side Lobe Suppression: Amplitude of the P_2 SLS (side lobe suppression) pulse can be selected from -19 to +6 dB, relative to P_1, in 1 dB increments. P_2 pulse can be switched ON or OFF by a selector switch.

5. Interference/DBL Interrogation: The interference pulse and double interrogation functions are combined in one switch selector and cannot be selected simultaneously. The function can be switched ON or OFF by a selector switch. The double interrogation may not be any closer than 24.5 µs to P_3 of the first interrogation and is independent of transponder mode selected.

6. UUT Pulse Spacing Detector: Transponder replies are verified for proper pulse position by selection of a narrow window, using a rear panel switch. In narrow position, the pulses must be within ±100 ns of their designated position to be recognized and displayed in XPDR Code Display readout. A wide window is provided by the rear panel selector switch when pulse position accuracy verification is not desired.

1-2-4 UUT MEASUREMENTS

1. Transmitter Frequency Counter: Average frequency of one (1) pulse in a reply (XPDR Mode) or an interrogation (DME Mode) is counted and continuously displayed. In DME Mode, either P_1 or P_2 can be selected to be counted by a selector switch; in XPDR Mode, either F_1 or F_2 can be selected.

2. Transmitter Frequency Discriminator: Frequency variation within the measured pulse may be viewed at the discriminator output jack. A reference voltage is supplied after the measured pulse, which represents the average frequency displayed on UUT transmitter frequency counter display.

3. Transmitter Power Meter: Transmitter power is measured by a peak power detector and displayed on a front panel readout. The resolution of the front panel readout is 1 watt. In DME Mode, either P_1 or P_2 is measured. In XPDR Mode, either F_1 or F_2 is measured.

1-2-5 TACAN TEST SET

The ATC-1400 from SN 1168 on is wired to allow interfacing with the T1401 TACAN Bearing Generator. This provides a total TACAN Test Set. The TACAN "ON/OFF" signal to the TACAN Bearing Generator is through rear panel connector J6, pin 25.

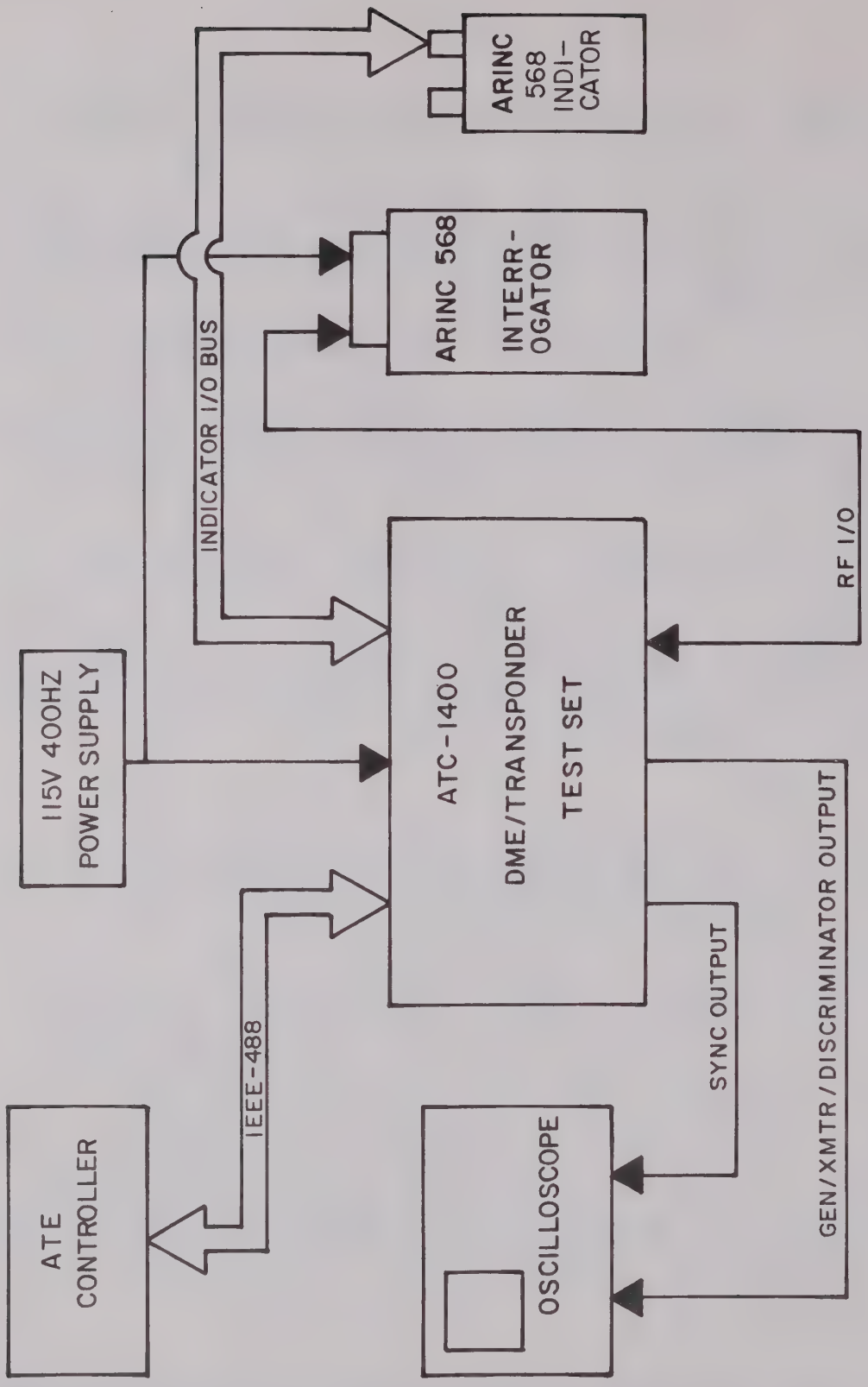


Figure 1-1 ATC-1400/ARINC 568 DME
FUNCTIONAL BLOCK DIAGRAM

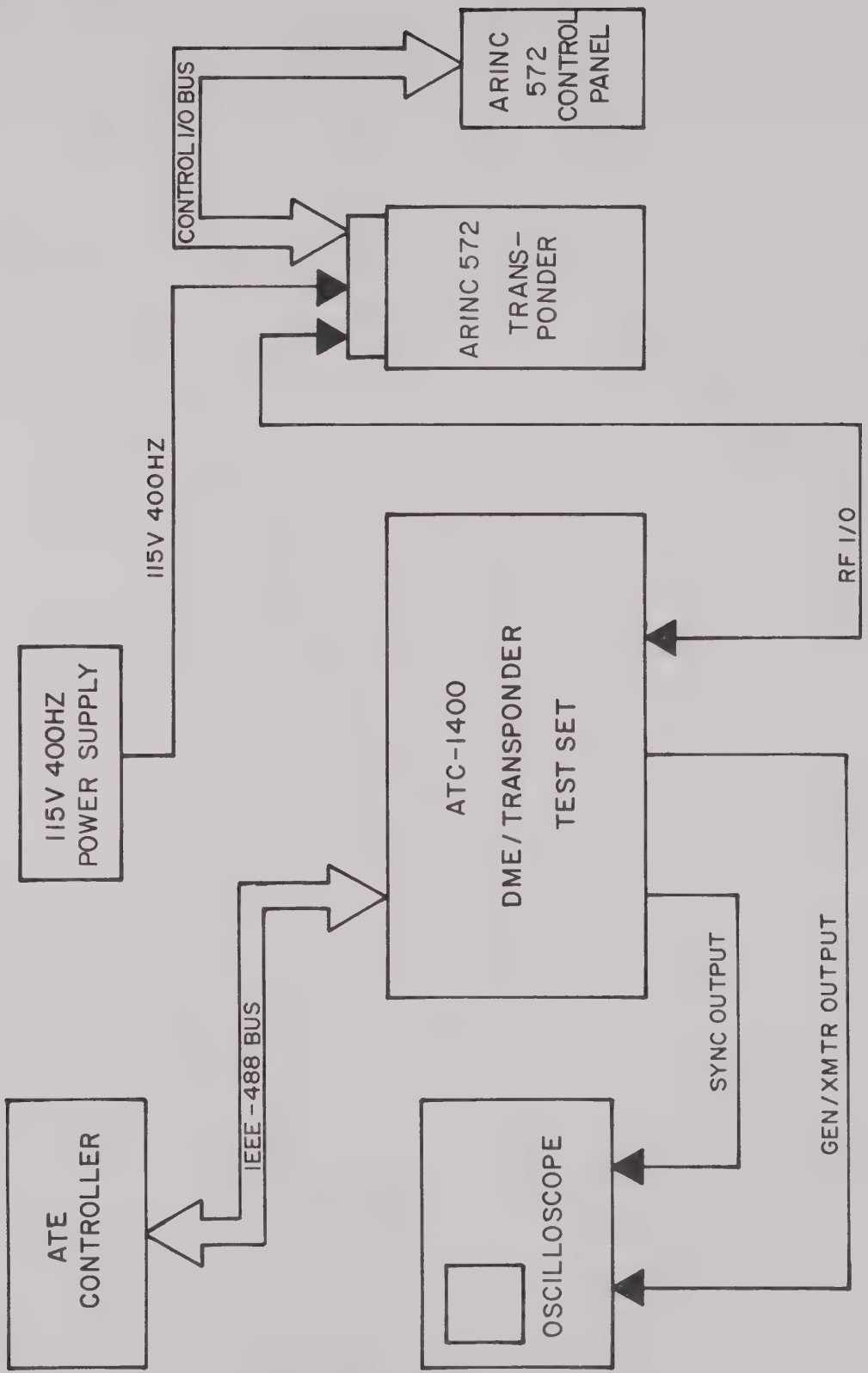


Figure 1-2 ATC-1400/ARINC 572 TRANSPONDER FUNCTIONAL BLOCK DIAGRAM

SECTION 2 - INSTALLATION

2-1 GENERAL

Installation of the ATC-1400 is a simple procedure which consists primarily of:

a. Setting instrument into an operating position.

b. Furnishing electrical power to test set by connecting AC power cable to available power source (either 105 to 120 VAC or 220 to 250 VAC, 50 to 400 Hz).

NOTE

- As illustrated in ATC-1400/ARINC 568 DME Functional Block Diagram on Page 1-4, and ATC-1400/ARINC 572 Transponder Functional Block Diagram shown on Page 1-5, accessory test equipment required to test ARINC DME and transponder systems consists of an oscilloscope.

Also included in this section are recommendations regarding installation/operating safety, equipment inspection, power requirements, required installation tools and bench/rack installations.

2-1-1 SAFETY PRECAUTIONS

Listed below are several important precautions which must be observed during all phases of system installation and operation. IFR, Inc., assumes no liability for customer's failure to comply with any of the safety precautions outlined in this manual.

COMPLYING WITH INSTRUCTIONS

Installation/operating personnel should not attempt to install or operate system without reading and complying with all instructions contained in this manual. All procedures contained in this manual must be performed in exact sequence and manner described.

GROUNDING REQUIREMENTS

To minimize shock hazard, all equipment chassis and cabinets must be connected to electrical ground. For this purpose, all IFR, Inc., test sets are equipped with a standard three-prong power cable which must be connected to a properly grounded three-prong wall receptacle. To summarize, it is customer's responsibility to:

1. Have a qualified electrician check wall receptacle(s) for proper grounding.

2. Replace any standard two-prong wall receptacle(s) with properly grounded three-prong receptacle(s).

WARNING

- Due to potential safety hazards, use of a three-prong to two-prong adapter plug is not recommended.

OPERATING SAFETY

Due to presence of potentially lethal voltages within test equipment, operating personnel must not remove test equipment covers at any time. Component replacement and internal adjustments must be made by qualified maintenance personnel only.

OBSERVING "CAUTION" AND "WARNING" LABELS

Extreme care should be exercised when performing any operations preceded by a "CAUTION" or "WARNING" label. "CAUTION" labels appear where possiblity of damage to equipment exists, while "WARNING" notes are used to denote a condition where a shock hazard exists, exposing personnel to possible bodily injury.

2-1-2 EQUIPMENT INSPECTION

All IFR, Inc., test sets are carefully inspected for material defects and are subjected to a thorough performance check prior to leaving the factory. All sets are shipped to customer in excellent mechanical/electrical condition. Upon receipt of shipment, receiving personnel should:

1. Account for presence of all equipment and accessories as listed on packing slip.

2. Inspect all equipment for visible or concealed damage which may have occurred in transit. If damage is apparent, see "RECEIVING INSPECTION/UNPACKING" sticker affixed to shipping container for "Damage Claim" procedure.

2-1-3 POWER REQUIREMENTS

The ATC-1400 power supply can operate over a voltage range of 95 to 230 VAC. No internal wiring or switching changes are required, prior to applying AC power to the test set. Instantaneous surge current at turn-on is less than 50 Amps. Input current will vary to maintain constant power over the input voltage range (approximately 100 W), so it is important the fuse selected has the correct rating for proper operation. The recommended fuse rating for the input voltage is listed below:

INPUT VOLTAGE	AC LINE FUSE RATING
95 to 130 VAC	3 Amp SLO BLO
130 to 230 VAC	1.5 Amp SLO BLO

2-1-4 INSTALLATION EQUIPMENT

None required; all electrical connections required to ready instrument for operation can be easily made by hand, without use of any special tools.

2-1-5 INSTALLATION PROCEDURE

The ATC-1400 can be installed in either a bench-top or rack-mount fashion. All IFR, Inc., test sets are normally shipped from factory with plastic feet installed for a bench-top installation. Conversion from bench-top to rack-mount installation is possible by ordering "Rack-Mount Kit" (IFR, Inc., Part Number 1001-0000-002). One kit per instrument is required for installation.

CAUTION

- Special care must be taken to avoid restriction of air flow to intake vent located on rear panel, and exhaust vent located on left side panel of ATC-1400 when installing instrument in either a bench-top or rack-mount fashion.

2-2 ATC-1400 DME T_D SYNC (SW301) AND RANGE SELECT (SW501) SWITCH POSITIONING

Remove card cage cover on rear panel of ATC-1400 (see Figure 2-1) and select the desired SYNC and maximum range if it differs from the factory preset position. Replace cover and GPIB shell screws before installation. The DME T_D SYNC Switch (SW301) located on the XPDR DECODER P.C. Board (30-223) can be positioned so the ATC-1400 Test Set will SYNC before range reply pulse pairs only, or SYNC before every DME reply pulse pair. The DME RANGE Switch (SW501) located on the DME RANGE P.C. Board (30-201) can be set for 100 nmi, 200 nmi or 400 nmi maximum range.

The different switch positions, for both the DME T_D to SYNC Switch and DME RANGE switches, along with the factory preset switch positions are shown below:

SW301 Positions	1	2	FUNCTION	PRESET
	ON	OFF	Sync on Range Replies Only	No
	OFF	ON	Sync on all DME Replies	Yes

SW501 Positions	1	2	3	4	FUNCTION	PRESET
	ON	OFF	OFF	OFF	Maximum Range 100 nmi	No
	OFF	ON	OFF	OFF	Maximum Range 200 nmi	No
	OFF	OFF	OFF	ON	Maximum Range 400 nmi	Yes

Refer to ATC-1400 rear panel view with the card cage exposed in Figure 2-1 below, for the location of DME T_D SYNC Switch (SW301) and DME range switch (SW501).

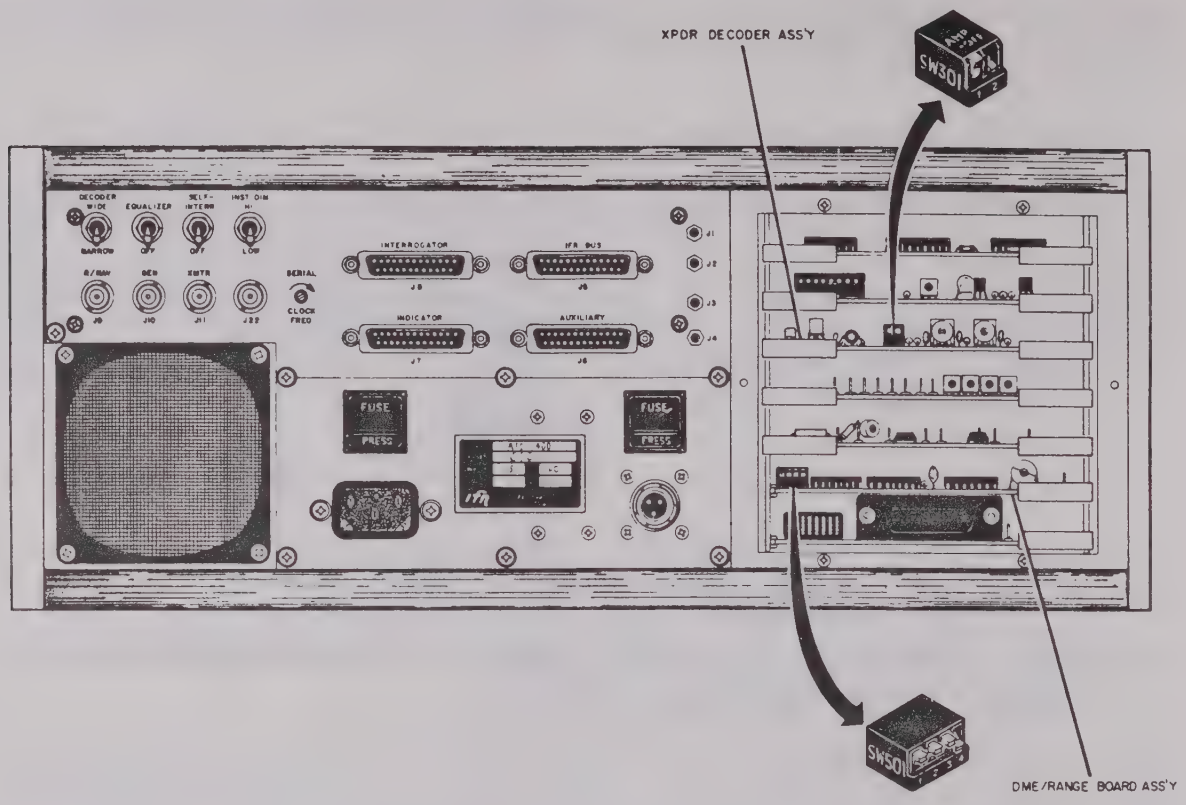


Figure 2-1 Rear Panel Card Cage View

2-3 SYSTEM INTERCONNECT CABLES

For attaching interconnect cables and power cords to test ARINC 568 DME Interrogator equipment, see Figure 2-2 (Page 2-6), and Figure 2-3 (Page 2-7) for testing ARINC 572 Transponder equipment.

2-3-1 ARINC 568 INTERROGATOR INTERFACE

The ARINC 568 Interrogator can be interfaced with the ATC-1400 Test Set through a rear panel connector (Interrogator J-8), which provides the 2 out of 5 VOR-Paired Channel Frequency Code necessary for channeling the interrogator, eliminating the need for a DME control unit.

NOTE

- To properly interface the ARINC 568 Interrogator unit to ATC-1400 test set rear panel connector (Interrogator J-8), an accessory wiring harness is required. The necessary wiring harness can be fabricated by the user. A typical accessory wiring harness is shown on Figure 2-4, page 2-9, and the interconnect diagram is shown on Figure 2-5, page 2-11.

2-3-2 ARINC 568 INDICATOR INTERFACE

The ARINC 568 digital indicator can be interfaced with the ATC-1400 Test Set through the rear panel connector (Indicator J-7) which provides the signals necessary to operate the unit. A typical interconnect cable is shown in Figure 2-4 and wiring diagarm is shown in Figure 2-5. The ATC-1400 Test Set is capable of reading serial range data eliminating the need for a separate indicator.

2-4 POWER UP PROCEDURE

Remove 3 conductor AC power cable from ATC-1400 shipping container and connect female end to POWER RECEPTACLE (56) on rear panel of ATC-1400. Refer to Figure 3-2, page 3-15, for location of test set POWER receptacle. Connect 3-pin grounded plug on opposite end of AC power cable to standard 3-pin grounded receptacle.

Place LINE Switch (35) (refer to Figure 3-1, page 3-2, for location of test set LINE Switch) to "ON" Position to energize test set and verify LINE Switch (35) and ATC-1400 displays are illuminated.

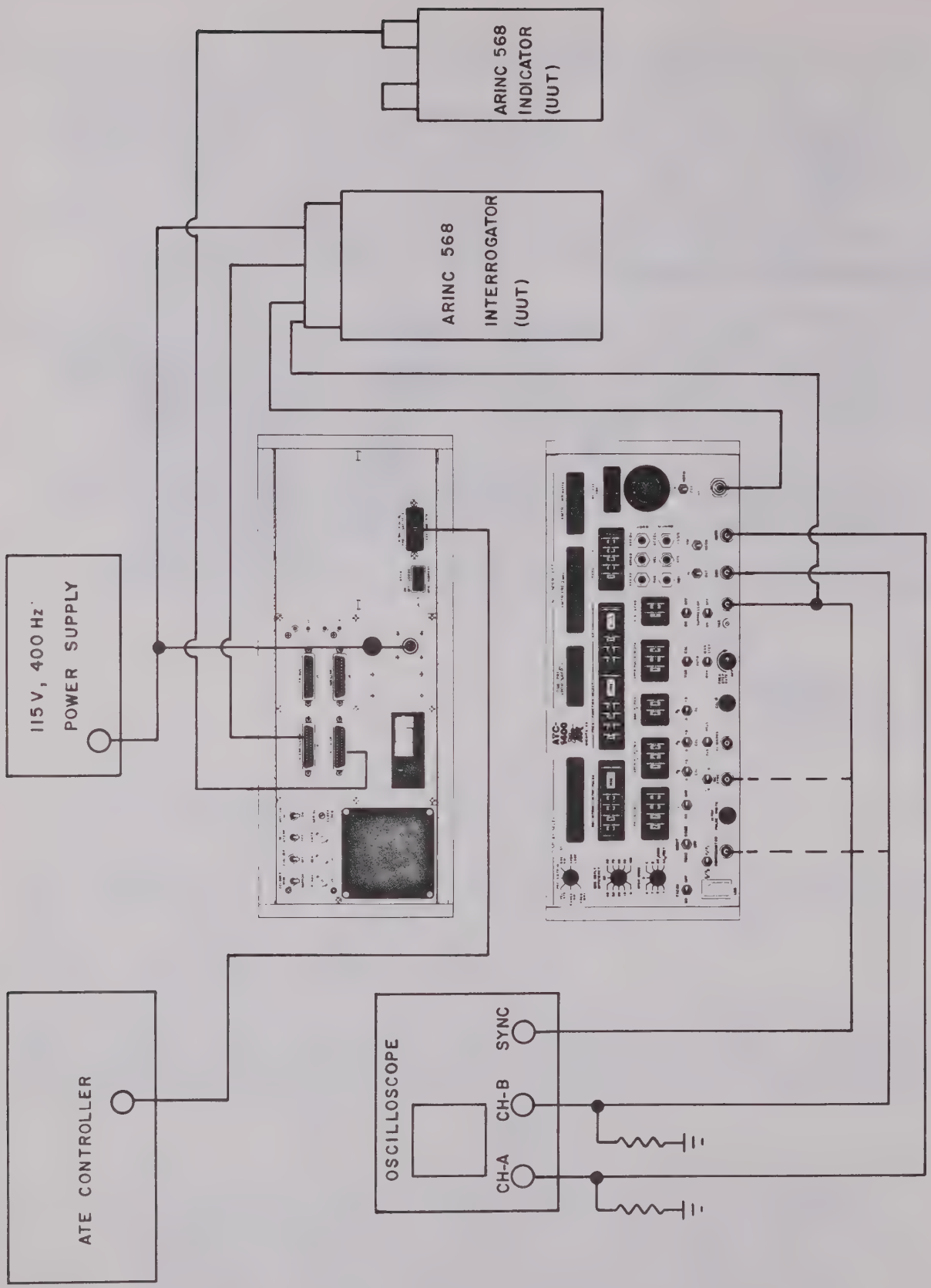


Figure 2-2 ATC-1400/ARINC 568 DME INTERFACE

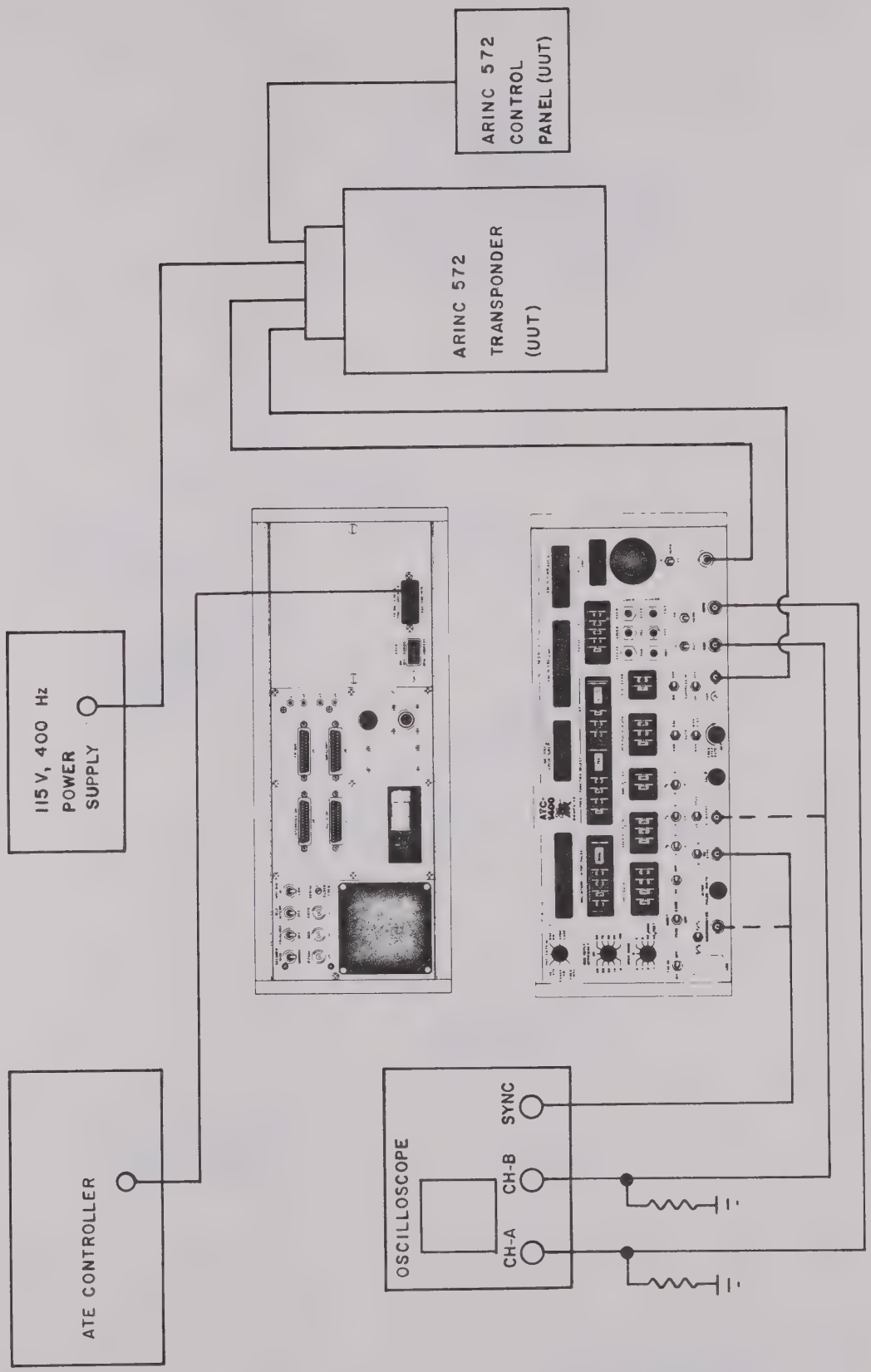


Figure 2-3 ATC-1400/ARINC 572 TRANSPONDER INTERFACE

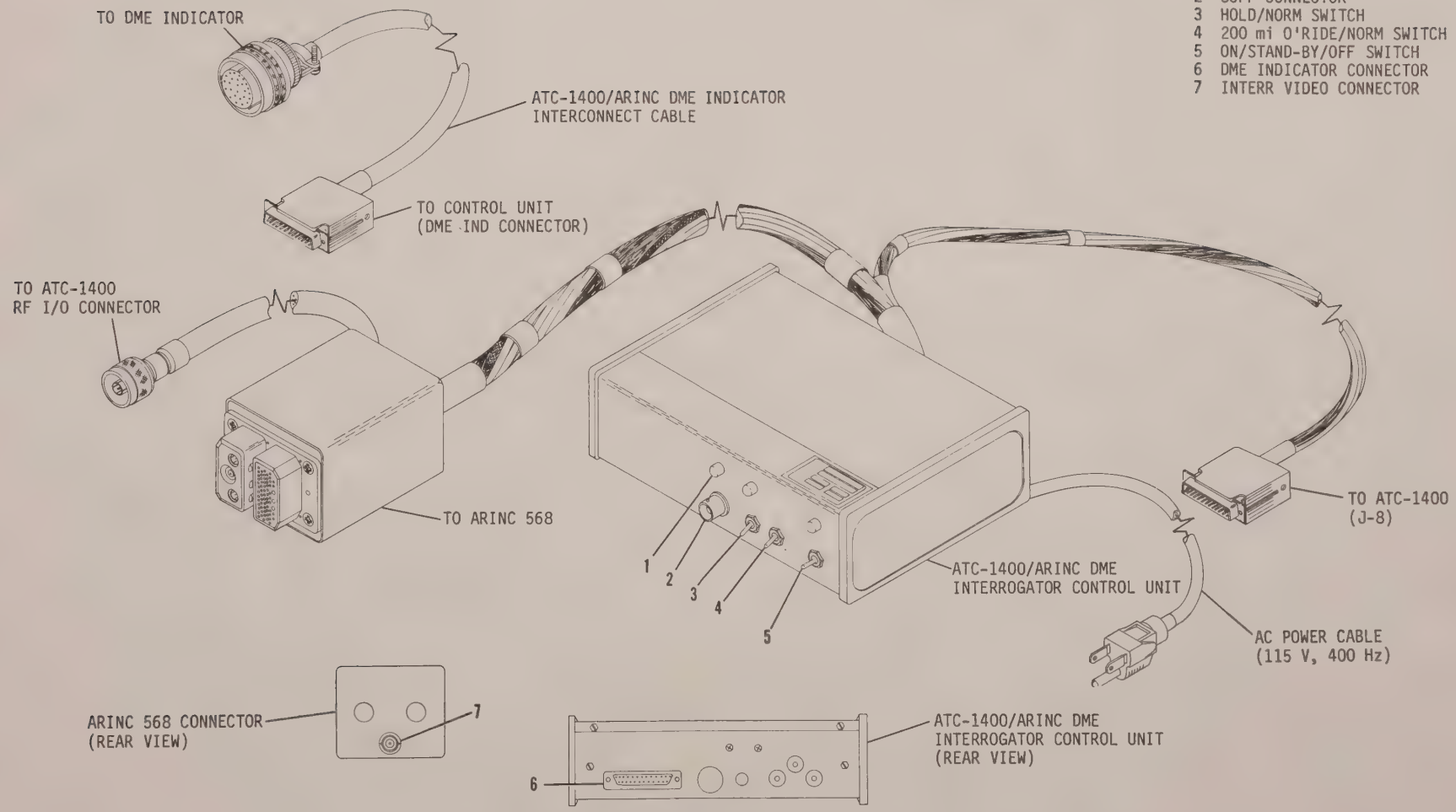


Figure 2-4 ATC-1400/ARINC 568 DME INTERCONNECT ASSEMBLIES

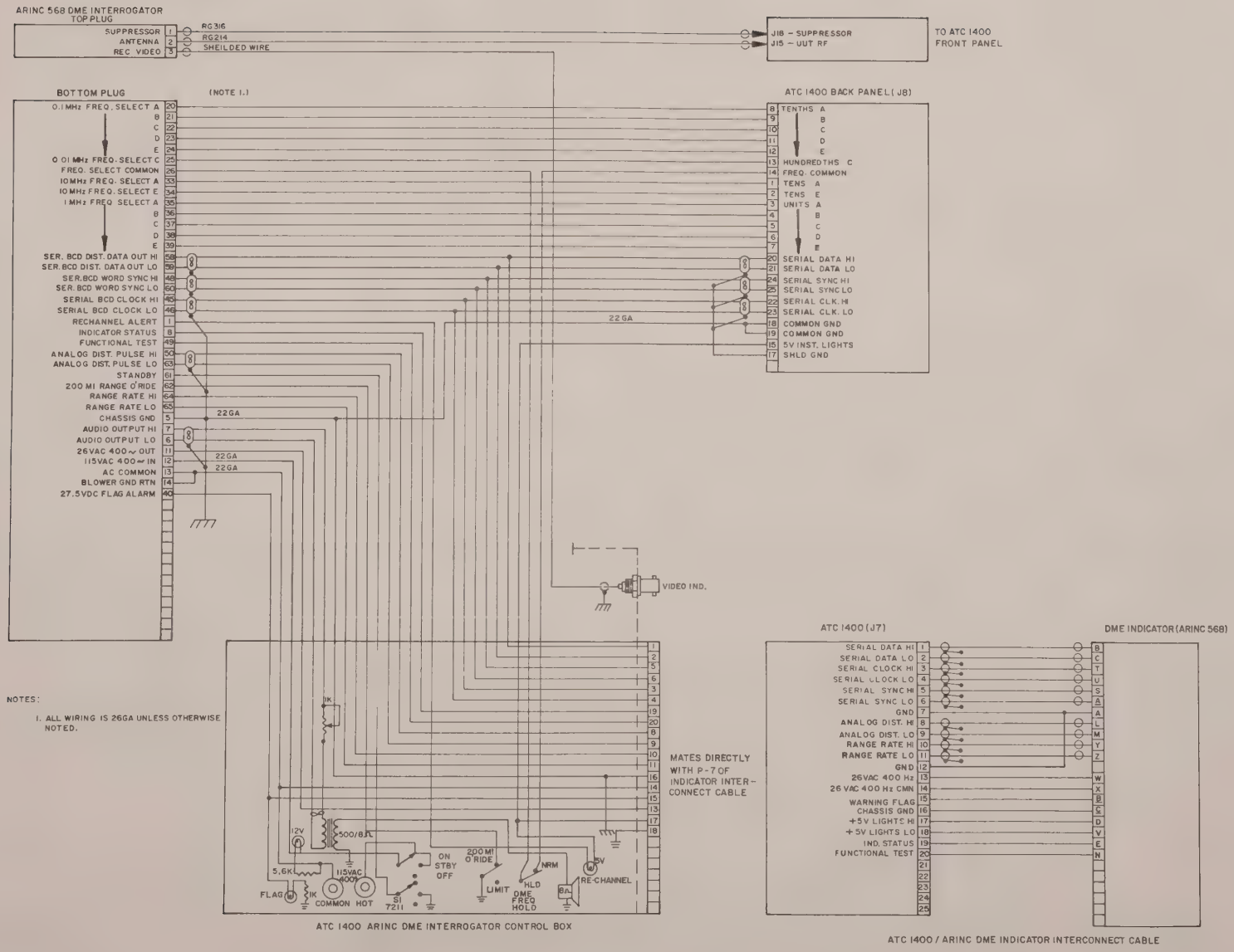


Figure 2-5 ATC-1400/ARINC 568 DME INTERCONNECT WIRING DIAGRAM

SECTION 3 - DESCRIPTION OF CONTROLS, CONNECTORS AND INDICATORS

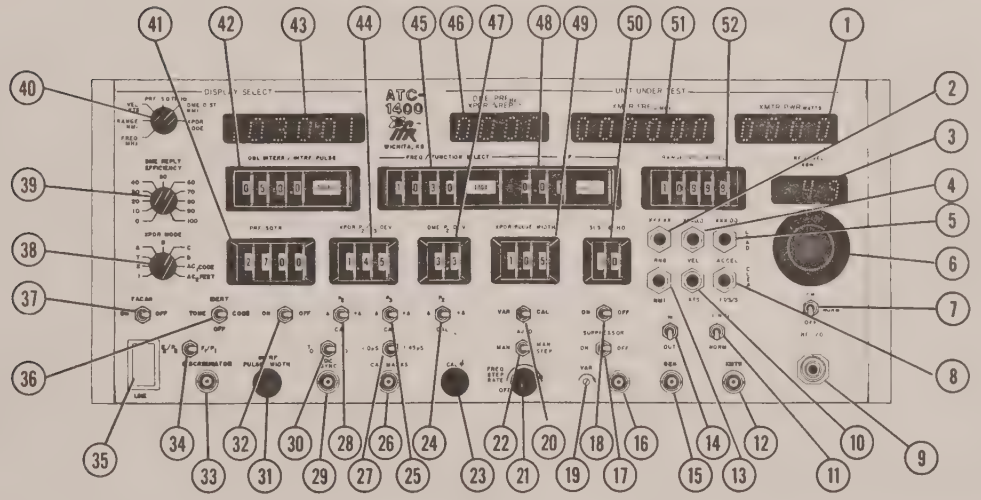


FIGURE 3-1 ATC-1400 Front Panel

1 XMTR PWR WATTS Display
2 LOAD RNG Push-button Switch
3 RF LEVEL -dBm Display
4 LOAD VEL Push-button Switch
5 LOAD ACCEL Push-button Switch
6 RF LEVEL Control
7 CW/NORM/OFF Switch
8 CLEAR ACCEL Push-button Switch
9 RF I/O Connector
10 CLEAR VEL Push-button Switch
11 -1 NMi/NORM Switch
12 XMTR Connector
13 CLEAR RNG Push-button Switch
14 IN/OUT Switch
15 GEN Connector
16 SUPPRESSOR OUTPUT Connector
17 SUPPRESSOR ON/OFF Switch
18 SLS/ECHO ON/OFF Switch
19 SUPPRESSOR VAR Adjustment
20 XPDR PULSE WIDTH VAR/CAL Switch
21 FREQ STEP RATE Control
22 MAN/AUTO/MAN STEP Switch
23 CAL Ø Control
24 DME DEV P_2/CAL Switch
25 XPDR DEV P_3/CAL Switch
26 CAL MARKS Connector
27 1.0 µS/1.45 µS Switch
28 XPDR DEV P_2/CAL Switch
29 SYNC Connector
30 TO/TAC/TD Switch
31 INTERF PULSE WIDTH Control
32 PRF/SQTR ON/OFF Switch
33 DISCRIMINATOR Connector
34 F_2/P_2 F_1/P_1 Switch
35 LINE Switch
36 IDENT TONE/OFF/CODE Switch
37 TACAN ON/OFF Switch
38 XPDR MODE Control
39 DME REPLY EFFICIENCY Control
40 DISPLAY SELECT Control
41 PRF/SQTR Thumbwheels
42 DBL INTERR/INTERF PULSE Thumbwheels
43 DISPLAY SELECT Readout
14 XPDR P_2/P_3 DEV Thumbwheels
45 FREQ/FUNCTION SELECT Thumbwheels
46 DME-PRF Hz XPDR - % REPLY Display
47 DME P_2 DEV Thumbwheels
48 ΔF Thumbwheels
49 XPDR PULSE WIDTH Thumbwheels
50 SLS/ECHO Thumbwheels
51 XMTR FREQ MHz Display
52 RANGE/VEL/ACCEL Thumbwheels

ITEM	NAME	DESCRIPTION

1. XMTR PWR WATTS Display
Provides a continuous visual display of peak instantaneous RMS power of the UUT from 10-1999 watts and EEEE when over range. In DME mode of operation, either the first or second interrogation pulse is measured; in transponder mode either the first or second framing pulse is measured.

NOTE

- The ATC-1400 Test Set will recognize pulses above 10 Watts Peak Power and 1.4 Hz PRF; however, accuracy is specified for signals above 50 Watts and 10 Hz. The ATC-1400 does not filter out undesired DC pulses or harmonics which may affect power measurement.

2. LOAD RANGE Push-button Switch (DME)
Programs a fixed range distance from 000.00 NMI to 399.99 NMI as selected on RANGE/VEL/ACCEL Thumbwheels (52). Selection of LOAD RANGE function will automatically clear velocity and acceleration function.

3. R.F. LEVEL -dBm Display
Displays the programmed peak R.F. power of the generator in dB below 1 mW, as selected by R.F. LEVEL Control (6) or remote control (GPIB).

NOTE

- The RF LEVEL may be programmed from 0 to -127 dBm in 1 dB steps; however, accuracy is specified from 0 to -110 dBm.

4. LOAD VEL Push-button Switch (DME)
Programs velocity from 000.0 KTS to 3990.0 KTS, as selected on RANGE/VEL/ACCEL Thumbwheels (52). Selection of LOAD VEL function clears acceleration to zero and presets acceleration to decrement velocity.

5. LOAD ACCEL Push-button Switch (DME)
Programs acceleration from 000.00 FT/S/S to 399.00 FT/S/S as selected on RANGE/VEL/ACCEL Thumbwheels (52). Selection of LOAD ACCEL function will also program the ATC-1400 with the last programmed value of velocity. A non-zero acceleration will decrement velocity to zero, then automatically switch to outbound and increment. Velocity will increment to maximum value of 4000 KTS, then automatically switch to inbound and decrement.

ITEM	NAME	DESCRIPTION

6. R.F. LEVEL Control
Adjusts R.F. generator level in 1 dB steps by slowly turning control knob. Spinning control rapidly causes R.F. LEVEL Display (3) to change rapidly, but does not change R.F. generator output level. Generator output level is programmed to a new value as soon as control turning rate is slowed. This feature allows rapid R.F. level changes without undue wear on relays and switches which program the R.F. attenuator.

7. CW/NORM/OFF Switch

"CW" Position - Supplies a continuous-wave signal, which provides a convenient output for test and calibration of the ATC-1400.

"NORM" Position - Allows ATC-1400 to operate as a flight simulator.

"OFF" Position - Inhibits all pulses the ATC-1400 is capable of generating.

8. CLEAR ACCEL Push-button Switch (DME)
Clears previously loaded acceleration information to 0 FT/S/S. Selection of CLEAR ACCEL function will also program test set with the last programmed value of velocity.

NOTE

- The ATC-1400 will keep in memory the last programmed value of velocity, which can be recalled by pressing the ACCEL CLEAR Push-button Switch (8). This feature will speed operation of test set for the operator, if one value of velocity is commonly used.

9. R.F. I/O Connector
Connects all interrogation and reply R.F. pulses to the antenna port of the UUT.

10. CLEAR VEL Push-button Switch (DME)
Clears previously selected velocity information to 0 knots. Selection of CLEAR VEL function will also clear acceleration to 0 FT/S/S.

11. -1 NMI/NORM Switch (DME)

"NORM" Position - Selects normal range on the test set of 0 to 399.99 nmi.

"-1 NMi" Position - Subtracts one nmi from range, programming test set to operate from -1 nmi to 398.99 nmi.

ITEM	NAME	DESCRIPTION

12. XMTR Connector
R.F. pulses transmitted by UUT are detected by the ATC-1400 and presented at this port. Detected video can be observed by connecting a coax from this port to an oscilloscope. The connecting coax should be terminated to 50 ohms at oscilloscope end to preserve pulse shapes.

13. CLEAR RNG Push-button Switch (DME)
Clears previously selected range information to 0 nmi. Selection of CLEAR RNG function will also clear previously selected velocity and acceleration information.

14. IN/OUT Switch (DME)

"IN" Position - A non-zero velocity will decrement range to zero, then automatically switch to outbound and increment. Range will increment to maximum value of 399.99 nmi, then automatically switch to inbound and decrement. Maximum range delay can be selected at the card cage on rear of the ATC-1400 to be 100, 200, or 400 nmi.

"OUT" Position - Procedure is the same as for inbound only direction is reversed.

NOTE

- It is possible for velocity to be outbound while switch is to "IN" Position. To change direction, place switch to "OUT" Position, then back to "IN" Position.

15. GEN Connector
R.F. output pulses from generator are detected and presented at this port, to enable viewing transponder interrogations and interference pulses, DME TACAN reference groups, TACAN AM, ident and equalizer pulses, range replies and squitter. Detected pulses can be observed by connecting a coax from this port to an oscilloscope. Connecting coax must be terminated to 50 ohms at scope end to preserve pulse shapes.

16. SUPPRESSOR OUTPUT Connector
Mutual suppression pulses are provided at this port, for both transponder and DME. Level of suppression pulses can be adjusted by SUPPRESSOR VAR Adjustment (19). Pulse occurs prior to range replies in DME mode and is coincident with P_3 pulse in transponder mode.

ITEM	NAME	DESCRIPTION

17. SUPPRESSOR ON/OFF Switch

"ON" Position - Provides suppressor pulses to both transponder and DME.

"OFF" Position - Inhibits suppressor pulses within ATC-1400.

18. SLS/ECHO ON/OFF Switch

"ON" Position - Echo replies are generated in DME mode; in transponder mode, P_2 side-lobe suppression pulses are enabled.

"OFF" Position - Both echo replies and P_2 side-lobe suppression pulses are inhibited.

NOTE

- SLS/ECHO Thumbwheel Switches (50) select amplitude of echo replies, P_2 side-lobe suppression pulses and interference pulses.

19. SUPPRESSOR VAR Adjustment

Level of the suppression pulse can be adjusted by this control. Clockwise rotation increases level and counterclockwise rotation decreases level of suppression pulse.

20. XPDR PULSE WIDTH VAR/CAL Switch (XPDR)

"VAR" Position - Selects a variable pulse width (as read from the XPDR PULSE WIDTH Thumbwheels (49)) from .15 μs to 1.95 μs, in .05 μs increments.

NOTE

- Generator output level is not specified below .2 μs pulse width.

"CAL" Position - Selects a transponder pulse width of 0.8 μs.

21. FREQ STEP RATE Control

The rate the channel frequency is incremented automatically is determined by the position of this control. Clockwise rotation increases frequency step rate. Full counterclockwise detent position, disables automatic frequency step rate and enables manual stepping.

22. MAN/AUTO/MAN STEP Switch

"MAN" Position - This position is normally selected while operating the ATC-1400. The channel frequency is determined by the selection of the FREQ/FUNCTION SELECT Thumbwheels (45).

"AUTO" Position - Channel frequency is incremented automatically in 1 MHz steps in this position. Step rate is controlled by positioning of FREQ STEP RATE Control and FREQ/FUNCTION SELECT Thumbwheel (45) switches are DISABLED. Power-up of ATC-1400 with MAN/AUTO/MAN STEP Switch (22) in "AUTO" position, defaults test set to 1030 MHz.

"MAN STEP" Position - Channel frequency can be incremented manually in 1 MHz steps by placing switch momentarily in this position.

NOTE

- In transponder function, the frequency is incremented in 1 MHz steps from the frequency selected on FREQ/FUNCTION SELECT Thumbwheels (45) and is terminated at 1213 MHz. In DME Function all X and Y Channels can be incremented automatically by using the AUTO Channel feature along with the 2 out of 5 code output at J8. Stepping starts at the frequency and channel (X or Y) selected by FREQ/FUNCTION SELECT Thumbwheels (45) after placing MAN/AUTO/MAN STEP Switch (22) to "AUTO" Position from "MAN" Position, and proceeds in 1 MHz increments as shown below:

AUTOMATIC FREQUENCY STEPPING

X Channel	Y Channel
962 MHz to 1020 MHz	1088 MHz to 1146 MHz
1157 MHz to 1213 MHz	1031 MHz to 1087 MHz
Terminate *	Continue *

* When channel stepping for X Channel reaches 1213 MHz AUTO Stepping terminates; AUTO Stepping for Y Channel will automatically return to 1088 MHz after reaching 1087 MHz and continue stepping.

23. CAL Ø Control (XPDR)
Adjusts the phase of timing calibration pulses with respect to interrogation pulses. Clockwise rotation delays timing pulses and enables the operator to align leading edge of timing pulses with P_1 of reply.

24. DME DEV P_2/CAL Switch (DME)

"-Δ" Position - Advances position of P_2 pulse from nominal, by value selected on the DME P_2 DEV Thumbwheels (47), in microseconds.

ITEM	NAME	DESCRIPTION

"CAL" Position - P_2 pulse remains in nominal position. DME DEV P_2/CAL Thumbwheels (47) have no effect on deviating P_2 pulses.

"+Δ" Position - Delays position of P_2 pulse from nominal, by value selected on DME P_2 DEV Thumbwheels (47) in microseconds.

25. XPDR DEV P_3/CAL Switch (XPDR)

"-Δ" Position - Advances position of P_3 pulse from nominal, by value selected on XPDR P_2/P_3 DEV Thumbwheels (44) in microseconds.

"CAL" Position - P_3 pulse remains in nominal position. XPDR P_2/P_3 DEV Thumbwheels (44) have no effect on deviating P_3 pulses.

"+Δ" Position - Delays position of P_3 pulse from nominal, by value selected on XPDR P_2/P_3 DEV Thumbwheels (44) in microseconds.

26. CAL MARKS Connector
The 1.0 µs and 1.45 µs pulses are presented at this connector for timing measurement of various signals. This signal is useful in making accurate time measurements with an oscilloscope. Output signal of 1.0 µs or 1.45 µs is controlled by 1.0 µs/1.45 µs Switch (27).

27. 1.0 µs/1.45 µs Switch
Selects either the 1.0 µs or 1.45 µs calibration pulse presented at CAL MARKS Connector.

28. XPDR DEV P_2/CAL Switch

"-Δ" Position - Advances position of the P_2 pulse from nominal, by value selected on the XPDR P_2/P_3 DEV Thumbwheels (44) in microseconds.

"CAL" Position - P_2 pulse remains in nominal position. XPDR P_2/P_3 DEV Thumbwheels have no effect on deviating P_2 pulses.

"+Δ" Position - Delays position of the P_2 pulse from nominal, by value selected on the XPDR P_2/P_3 DEV Thumbwheels (44) in microseconds.

29. SYNC Connector
A negative oscilloscope sync pulse generated by test set is presented at this connector. Signal output is controlled by T_O/TAC/T_D Switch.

ITEM	NAME	DESCRIPTION

30. $T_0/TAC/T_D$ Switch

"T_0" Position - Provides a sync pulse 21 µs before P_1 of the interrogation in transponder mode and a sync pulse coincident with the 50% point of P_1 of the interrogation in DME mode.

"TAC" Position - Provides a sync transition pulse at 15 Hz to enable display of TACAN modulation, if TACAN is selected. No sync will occur if TACAN switch (37) is in "OFF" position.

"T_D" Position - Presents a sync pulse coincident with P_3 of the interrogation in transponder mode and a sync pulse prior to P_1 of a reply in DME mode.

31. INTERF PULSE WIDTH Control (XPDR)
Width of interference pulse is adjusted from .2 µs to 5 µs by this control. Clockwise rotation increases width of pulse.

32. PRF/SQTR ON/OFF Switch
Two position toggle switch which when placed in OFF position, will inhibit squitter in DME mode and interrogations in transponder mode.

33. DISCRIMINATOR Connector
The instantaneous frequency of the R.F. input pulses are discriminated and made available at this connector. The frequency modulation of the transmitter under test can be monitored within one pulse or between two pulses. The discriminator produces noise when no R.F. is present.

34. F_2/P_2 F_1/P_1 Switch
Measures UUT frequency and power of the F_1 or F_2 reply pulse in XPDR mode and frequency and power of the P_1 or P_2 reply pulse in DME mode.

35. LINE Switch
Applies external AC Power to ATC-1400 Test Set and 26 VAC Power to indicator under test.

36. IDENT TONE/OFF/CODE Switch (DME)

"TONE" Position - Enables 1350 Hz CW tone.

"OFF" Position - Inhibits both continuous and code tones.

"CODE" Position - Modulates 1350 Hz tone with morse code "IFR". Repetition rate is approximately every 8 seconds.

ITEM	NAME	DESCRIPTION

37. TACAN ON/OFF Switch (DME)

"ON" Position - Simulates a TACAN ground station. The bearing is fixed at 180°. A 15 Hz sync is provided for observing the TACAN modulation at the SYNC Connector (29).

"OFF" Position - Inhibits TACAN signals generated by test set.

38. XPDR MODE Control (XPDR)
Selects nominal P_3 pulse position of transponder interrogations. The AC_1 and AC_2 positions cause alternating A and C interrogations. Sync occurs before A interrogation, when AC_1 is selected and before C interrogation, when AC_2 is selected.

NOTE

- Mode A interrogation pulse spacing is same as IFF Mode 3.

39. DME REPLY EFFICIENCY Control (DME)
Range replies are produced only in response to a valid interrogation (i.e. P_1 to P_2 spacing of either 12 μs or 36 μs). Selection of any position of this control selects ATC-1400 reply efficiency rate (i.e. "50" position equals 50% reply rate and "100" position equals 100% reply rate).

40. DISPLAY SELECT Control
DISPLAY SELECT READOUT (43) will display a particular test condition for the control setting as listed below:

"FREQ MHz" Position -

1. Displays "A" when simulator is in automatic operation.
2. Displays "E" for incorrect programming.
3. Simulator frequency in MHz is counted and displayed when selected on FREQ/FUNCTION Select Thumbwheels (45). Frequency can be adjusted to within 10 kHz of desired channel by monitoring this display.
4. Enables serial data output of simulator range replies to indicator connector (J7).

ITEM	NAME	DESCRIPTION
	"RANGE NMI" Position (DME) -	1. Displays range delay in nautical miles when RANGE LOAD Push-button Switch (2) is selected. 2. Displays "C" to indicate a negative range. Range is less 1 nmi. (i.e. display reads C__0.01). 3. Displays "OFF" when FREQ/FUNCTION SELECT Thumbwheels (45) are in "XPDR" Position. 4. Enables serial data output of simulator range to indicator connector (J7).

NOTE

- This display can be used to monitor range delay when a non-zero velocity is loaded.

	"VEL KTS" Position (DME) -	1. Continuously displays simulator velocity in KTS and can be used to monitor velocity while acceleration is loaded. 2. Displays "OFF" when FREQ/FUNCTION SELECT Thumbwheels (45) are in "XPDR" Position. 3. Enables serial data output of simulator range replies to indicator connector (J7).

NOTE

- DISPLAY SELECT Readout (43) can be used to monitor velocity when acceleration is loaded. The value of acceleration is not displayed, but can be read from the RANGE/VEL/ACCEL Thumbwheels (52).

	"PRF/SQTR Hz" Position (DME) -	1. Total number and types of pulse pairs, listed below are counted and displayed with DISPLAY SELECT Control (40) in this position: a. Reference Groups (Main & Auxiliary) b. Identification and Equalizer Pulses c. Echo Replys d. Range Replys e. Squitter Pulses 2. Displays "OFF" with CW/NORM/OFF Switch (7) in "CW" or "OFF" Position.

ITEM	NAME	DESCRIPTION
		3. Enables serial data output of simulator range replies to indicator connector (J7).
	"PRF/SQTR Hz" Position (XPDR) -	1. Total number of interrogations per second selected on PRF/SQTR Thumbwheels (41) are counted and displayed on DISPLAY SELECT Readout (43).
	"DME DIST NMi" Position (DME) -	1. Enables serial data input of Interrogator range replies to be displayed on DISPLAY SELECT Readout (43).
		2. Displays "DDDD.DD" until the ATC-1400 receives a valid label from the Interrogator through INTERROGATOR Connector J8 (66). Only data following a valid label and last valid data received is displayed.
		3. Enables serial data output of interrogator range replies to the indicator under test through INDICATOR Connector J7 (67). With DISPLAY SELECT Control (4) in "DME DIST NMi" position, indicator under test will read only interrogator output. With DISPLAY SELECT Control (40) in any other position, indicator under test will read ATC-1400 range replies.
		4. DISPLAY SELECT READOUT (43) can be reset and last valid data received can be cleared from display by cycling DISPLAY SELECT Control (40) to any other position, then back to "DME DIST NMi" Position.
		5. Displays "OFF" when FREQ/FUNCTION SELECT Thumbwheels (45) are in "XPDR" Position.
	"XPDR CODE" Position (XPDR) -	1. A four digit octal code is decoded and displayed for "A" mode identification replies and "C" mode altitude replies are displayed either as a four digit octal code or as an altitude in thousands of feet. XPDR MODE Switch (38) determines which reply is decoded and what format is displayed on DISPLAY SELECT Readout (43).
		2. Displays "CCCCCC" or "CCCCC.C" when XPDR reply rate is zero.
		3. Displays "OFF" when FREQ/FUNCTION SELECT Thumbwheels are in "DME" Position.

ITEM	NAME	DESCRIPTION

41. PRF/SQTR Thumbwheels

DME Function - Select the mean squitter rate in Hz. ATC-1400 Squitter is defined as nominal level pulse pairs of random spacing generated at a mean squitter rate, as selected by thumbwheel setting.

XPDR Function - The interrogation rate in Hz is selected. When double interrogation rate is selected, interrogation rate is twice the thumbwheel value. When "AC" Mode is selected on XPDR MODE Control (38), the rate of "A" interrogations is half the value of thumbwheel setting.

42. DBL INTERR/INTERF PULSE Thumbwheels (XPDR)
Select either a double interrogation or an interference pulse. The numbers (in microseconds) relate to function viewed in the window. This feature will override normal transponder mode of operation.

43. DISPLAY SELECT Readout
Readout displays whatever information is selected on DISPLAY SEL Control (40).

44. XPDR P_2/P_3 DEV Thumbwheels (XPDR)
Position of the P_2 or P_3 pulse can be deviated from the nominal position by value selected on the thumbwheel switches, in microseconds.

45. FREQ/FUNCTION SELECT Thumbwheels
Select function of operation and frequency of test set. Numbers in MHz relate to function viewed in the window. Function and frequency is listed as follows:

ITEM NAME DESCRIPTION

WINDOW DISPLAY	OPERATION FUNCTION	RANGE	THUMBWHEEL RANGE
XPDR	TRANSPONDER	962 MHz - 1213 MHz	0962 - 1213
TAC Y	DME-Y Ch	Channel 1 - Channel 126	0001 - 0126
TAC X	DME-X Ch	Channel 1 - Channel 126	0001 - 0126
5 VOR PAIR	DME-Y Ch	108.05 MHz - 117.95 MHz	1080 - 1179
O VOR PAIR	DME-X Ch	108.00 MHz - 117.90 MHz	1080 - 1179
MHZ Y	DME-Y Ch	962 MHz - 1213 MHz	0962 - 1213
MHZ X	DME-X Ch	962 MHz - 1213 MHz	0962 - 1213

46. DME-PRF Hz XPDR - % REPLY Display

DME Function - Number of interrogations per second are counted and displayed continuously. Interrogations are decoded and an "F" is displayed for approximately .5 seconds, if P_2 pulse is not present or not within decoder window.

XPDR Function - Ratio of transponder replies to interrogations are sampled every 100 interrogations and displayed continuously. Display will read "50" when DOUBLE INTERR is selected on DBL INTERR/INTRF PULSE Thumbwheels (42) and the transponder replys to only one of the two interrogations.

"OFF" is displayed on DISPLAY SELECT READOUT (43) when PRF/SQTR ON/OFF Switch is placed in the "OFF" Position.

47. DME P_2 DEV Thumbwheels (DME)
Position of the P_2 pulse can be deviated from nominal position by value selected on thumbwheel switches in microseconds.

48. ΔF Thumbwheels
Deviates generator frequency from -9.99 MHz to +9.99 MHz. Frequency range is increased from 952.01 MHz to 1222.99 MHz. The ΔF switch has no effect on X or Y channel selection or 2 out of 5 code output at the INTERROGATOR Connector J8 (66).

49. XPDR PULSE WIDTH Thumbwheels (XPDR)
Width of the P_1, P_2 and P_3 pulse can be varied by the value selected on Thumbwheel switches, in microseconds.

50. SLS/ECHO Thumbwheels
Range is -19 to +19 dB. Accuracy is specified from -19 to +6 dB.

DME Function - Amplitude of echo reply is selected in dB, above nominal R.F. level.

XPDR Function - Amplitude of the P_2 side-lobe suppression pulse and interference pulse is selected in dB, above nominal R.F. level.

51. XMTR FREQ MHz Display
Average frequency of UUT's R.F. pulses are measured between 50% amplitude point and are displayed continuously. In DME mode, either P_1 or P_2 pulse is measured; either F_1 or F_2 pulse is measured in transponder mode.

52. RANGE/VEL/ACCEL Thumbwheels (DME)
Desired value of range, velocity, and acceleration can be simulated in the test set by selection of thumbwheel switches in knots for velocity, nautical miles for range and feet per second per second (Ft/Sec^2) for acceleration.

SELECTION	RANGE	THUMBWHEEL SETTING
Range	0 to 399.99 nmi	00000 to 39999
Velocity	0 to 3990 KTS	000XX to 399XX
Acceleration	0 to 399 Ft/Sec^2	000XX to 399XX

X = NOT USED

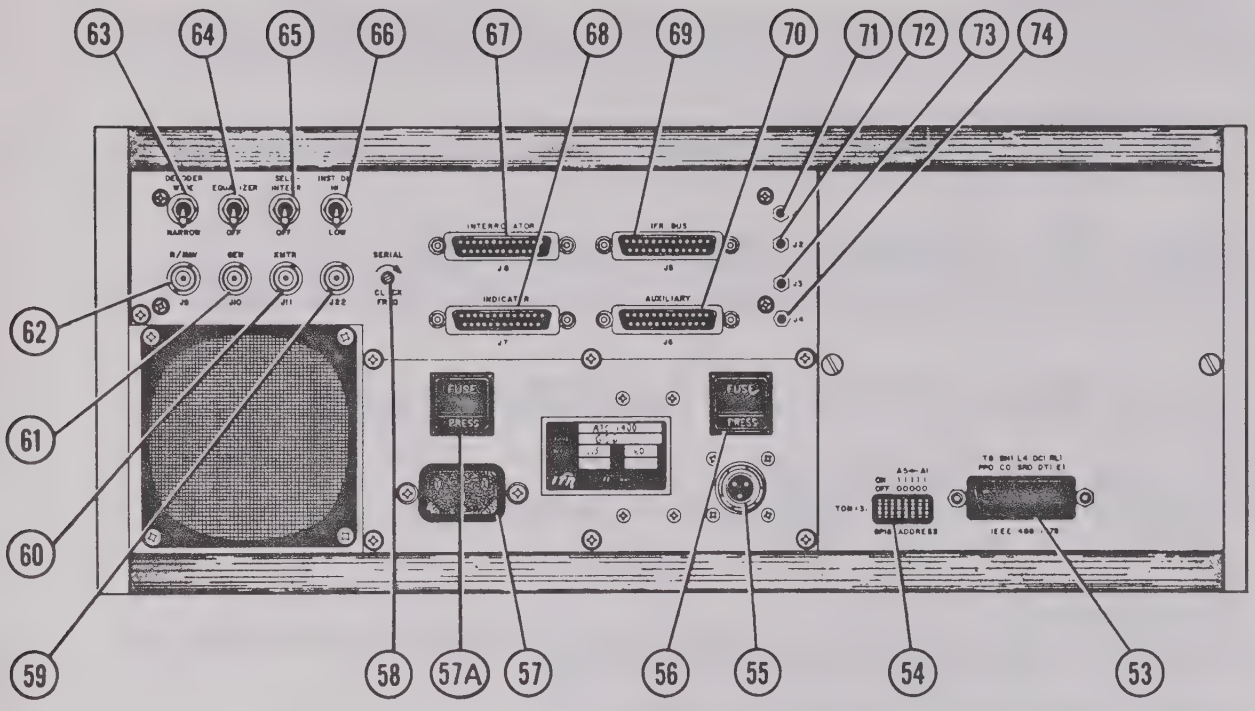


FIGURE 3-2 ATC-1400 Rear Panel

53 GPIB Connector
54 GPIB ADDRESS DIP Switches
55 115 V, 400 Hz INDICATOR POWER Connector
56 115 V, 400 Hz INDICATOR POWER Fuse
57 ATC-1400 POWER RECEPTACLE
57A AC LINE FUSE
58 SERIAL CLOCK FREQ Adjustment
59 EXTERNAL PULSE Connector (J22)
60 XMTR Connector (J11)
61 GEN Connector (J10)
62 R/NAV Connector (J9)
63 DECODER WIDE/NARROW Switch
64 EQUALIZER/OFF Switch
65 SELF-INTERR/OFF Switch
66 INST DIM HI/LOW Switch
67 INTERROGATOR Connector (J8)
68 INDICATOR Connector (J7)
69 IFR BUS Connector (J5)
70 AUXILIARY Connector (J6)
71 DABS INPUT Connector (J1)
72 TACAN INPUT Connector (J2)
73 30 MHz I.F. OUTPUT Connector (J3)
74 RF LEVEL INPUT Connector (J4)

ITEM	NAME	DESCRIPTION

53. GPIB Connector
24-pin female connector conforming to IEEE standard 488-1978 for interface of general purpose programmable instrumentation.

54. GPIB ADDRESS Dip Switches
Eight segment DIP switch used for setting IEEE-488 bus address for remote control mode of operation.

55. 115 V, 400 Hz INDICATOR POWER Connector (DME)
Applies 115 VAC 400 Hz to test set; this voltage is converted to 26 VAC, 400 Hz, which in turn is used to provide power for a DME indicator.

56. 115 V, 400 Hz INDICATOR POWER Fuse (DME)
AGC 1/2 Amp Fuse.

57. ATC-1400 POWER RECEPTACLE
Contains standard 3 prong power receptacle for ATC-1400 power cord.

57A. AC LINE FUSE
3 Amp SLO BLO fuse for voltages from 95-130 VAC. 1.5 Amp SLO BLO fuse for voltages from 130-230 VAC.

58. SERIAL CLOCK FREQ Adjustment (DME)
Adjusts serial clock frequency output of INDICATOR Connector (J7) from 7 kHz to 14 kHz. Clockwise rotation of potentiometer will increase frequency output.

59. EXTERNAL PULSE Connector
An Open-Collector or TTL signal is input to this connector from an auxiliary source which modulates the ATC-1400 RF Output. In transponder function a logic Ø will turn-on the ATC-1400 modulator. The lending edge of the RF Output pulse is delayed approximately 100 ns more than the trailing edge. In DME function a negative edge triggers one gaussian pulse with approximately a 3.5 µs delay measured at the 50% point.

The connector is always active, so in transponder function the input signal is added to the internally generated transponder interrogations and output at the RF I/O Connector (9) unless the PRF SQTR ON/OFF Switch (32) is placed in the "OFF" position. Only the signal input at this port will be output with PRF turned off.

60. XMTR Connector (J11)
R.F. pulses transmitted by UUT are detected with a linear voltage detector and resultant video is clipped at the 50% point and presented at this port. This TTL-compatible signal can be observed by connecting a coax cable from this port to an oscilloscope. Connecting coax may be terminated to 50 ohms at oscilloscope end, to preserve pulse shapes.

ITEM	NAME	DESCRIPTION

61. GEN Connector (J10)
The TTL-compatible signal which modulates ATC-1400 generator output is buffered and presented at this port. Detected pulses can be observed by connecting a coax cable from this port to an oscillscope. Connecting coax should be terminated to 50 ohms at oscilloscope end, to preserve pulse shape.

62. R/NAV Connector (J9)
Two 7 µs pulses are generated and presented at this port to test area navigation computers. One pulse is coincident with interrogation pulse and one pulse is coincident with reply pulse.

63. DECODER WIDE/NARROW Switch

"NARROW" Position - Selects a 1 µs window centered at 12 µs or 36 µs from P_1 in DME function of operation, and 220 ns windows centered at 1.45 µs intervals from F_1 in transponder function of operation.

"WIDE" Position - Selects a 4 µs window centered at 12 µs or 36 µs from P_1 in DME function of operation, and a 750 ns window centered at 1.45 µs intervals from F_1 in transponder function of operation.

NOTE

- In DME function if the 50% point of P_2 pulse is within ARINC 568 specifications. The ATC-1400 will generate range replies when "NARROW" position is selected. If pulse spacing is suspect on a UUT "WIDE" position may be selected.

64. EQUALIZER/OFF Switch (DME)
Normally placed to "EQUALIZER" Position. Equalizer pulse occurs 100 µs after identification pulse only if IDENT TONE/OFF/CODE Switch (36) is placed in either "TONE" or "CODE" Position.

65. SELF-INTERR/OFF Switch (DME)
Normally placed in "OFF" Position. ATC-1400 may be interrogated and will generate range replies without a DME UUT, if "SELF-INTERR" Position is selected. Rate of self interrogations is determined by selection on PRF/SQTR Thumbwheels (41). Squitter rate is uncalibrated when SELF-INTERR is enabled.

66. INST DIM HI/LOW Switch (DME)
Provides a method to test dimming circuits of an ARINC 568 DME Indicator.

ITEM	NAME	DESCRIPTION

"HI" Position - 5 volts is applied to Pin 7 of INDICATOR Connector (J7).

"LOW" Position - Open is applied to Pin 7 of INDICATOR Connector (J7).

67. INTERROGATOR Connector (J8) (DME)
25-pin female connector for interface of DME interrogator under test. ATC-1400 channels UUT with 2 out of 5 code outputs. Range data is received from UUT through this port and displayed on DISPLAY SELECT Readout (43), when DISPLAY SELECT Control (40) is placed in "DME DIST NMi" Position.

68. INDICATOR Connector (J7) (DME)
25-pin female connector for interface of ARINC 568 DME Indicator. Indicator under test should display exact range data transmitted by interrogator, as displayed on DISPLAY SELECT Readout (43) when DISPLAY SELECT Control (40) is placed in "DME DIST NMi" Position. Indicator should display ATC-1400 range in all other positions.

69. IFR BUS Connector (J5)
25-pin female connector for IFR, Inc. use only.

70. AUXILIARY Connector (J6)
25-pin female connector intended for use of auxiliary equipment.

71. DABS INPUT Connector (J1) (XPDR)
SMB input connector designed to receive PSK modulation from a Discrete Address Beacon System (DABS) simulator.

72. TACAN INPUT Connector (J2) (DME)
SMB input connector for interface of a TACAN Simulator.

73. 30 MHz I.F OUTPUT Connector (J3)
A sample of ATC-1400 I.F. Frequency of 30 MHz is presented at this connector.

74. RF LEVEL INPUT Connector (J4)
Additional ±3 dB level control of RF Output.

SECTION 4 - OPERATION

4-1 GENERAL

This section contains operating instructions relating to both local control (front panel) operation and remote control (GPIB) operation of the ATC-1400.

4-1-1 LOCAL CONTROL OPERATION

Paragraphs 4-2 and 4-3 contain test procedures for general testing of both Transponder and DME equipment. For purposes of clarity and ease of understanding, all instructions are presented as individual test procedures conforming to a "step-by-step" format. The procedures included are those most commonly associated with the ATC-1400 for Transponder and DME testing.

Each group of "EXAMPLE TEST PROCEDURES" for Transponder and DME testing is preceded by a brief introductory paragraph relating to the particular ATC-1400 function, followed by a table containing ATC-1400 initial control settings required for that function. Each individual step-by-step test procedure, in turn, contains the following common headings:

4-2-2	Test procedure number.
TEST PROCEDURE:	Name of procedure to be performed.
TEST OBJECTIVE:	Purpose or intent of procedure; if name of "TEST PROCEDURE" itself implies test objective, this heading will contain N/A (not applicable).
SPECIAL ACCESSORY EQUIPMENT REQ'D:	List of any special accessory test equipment required to complete procedure beyond ATC-1400 and UUT.
TEST SET-UP DIAGRAM:	A diagrammatic aid to operator in making proper connections between ATC-1400, UUT and special accessory equipment.

4-1-2 REMOTE CONTROL OPERATION

Remote communication with the ATC-1400 for testing Transponder and DME equipment is provided by use of the General Purpose Interface Bus (GPIB), which conforms to IEEE Standard 488-1978. All communication with the ATC-1400 over the GPIB are implemented with ASCII encoded character strings.

For purposes of clarity and ease of understanding, an alphabetical quick reference table showing each ASCII Command used in remote control operation (as seen from the computer terminal) is listed in paragraph 4-6. Paragraph 4-7 contains a detailed description for all commands.

4-1-3 PRE-OPERATIONAL CONSIDERATIONS

For maximum benefit of all operating procedures contained herein, it is strongly recommended that operator:

1. Thoroughly read and understand all steps of procedure to be performed, prior to its completion.

2. Be familiar with the circuit or unit under test so some idea is perceived as to the power, frequency and waveform to be expected at each test point. This knowledge will aid operator in performing the test procedure in a logical and efficient manner, with a minimum of blind searching.

4-1-4 ATC-1400 SELF TEST PROCEDURE

The correct operation of the ATC-1400 test set can be verified by performing the following self test procedure prior to testing XPDR and DME equipment.

1. Place ATC-1400 LINE Switch (35) to "ON" position and allow a 5 minute warm-up period. By selecting "FREQ MHz" position on DISPLAY SELECT Control (40), the actual generator frequency selected on FREQ/FUNCTION SELECT Thumbwheels (45) is counted and displayed on display select readout (43). Generator frequency can be fine tuned using ΔF Thumbwheels if necessary to match display frequency to selected frequency. Place DISPLAY SELECT Control (40) to "PRF SQTR Hz" position. ATC-1400 will now count and verify interrogation rate in XPDR Function of operation and total reply rate in DME function of operation.

4-1-5 OPERATING PRECAUTIONS

In addition to the general safety precautions listed under Section 2-1-1 of this manual, the operator must observe the following additional operating precautions:

1. When working with "live" circuits of high potential, keep one hand in pocket or behind back to avoid serious shock hazard.

2. Remove all jewelry or other cosmetic apparel before performing any test procedures involving "live" circuits.

3. Use only insulated troubleshooting tools when working with "live" circuits.

4. For added insulation, place rubber bench mat underneath all powered bench equipment, as well as a rubber floor mat underneath operator chair.

5. Heed all WARNINGS and CAUTIONS concerning maximum voltage and power inputs.

4-2 TRANSPONDER EXAMPLE TEST PROCEDURES

The step-by-step test procedures outlined in this section are for general application of the ATC-1400 for testing ATC (air traffic control) transponder aircraft equipment. Reference should be made to the transponder manufacturer's instruction manual covering the particular equipment under test for complete test procedures.

The procedures in this section are examples used to illustrate the operation of the ATC-1400 and as such are not intended to supersede or modify the manufacturer's recommended test or intended to include all tests necessary to certify transponder equipment. Specifications called out in the following example procedures are for illustration purposes only and therefore do not apply to any specific models of transponder equipment.

When testing transponder equipment, a steady or flashing "F" displayed on the DISPLAY SELECT readout indicates the transponder F_1 or F_2 pulse is not within specifications.

The example procedures contained in this section are:

4-2-2 MEASURING RECEIVER BANDWIDTH AND MINIMUM THRESHOLD LEVEL (MTL)
4-2-3 MEASURING SIDE LOBE SUPPRESSION (SLS)
4-2-4 MEASURING PULSE DEVIATION
4-2-5 VERIFICATION OF INTERROGATOR RECOVERY TIME
4-2-6 PULSE WIDTH DECODER OPERATION
4-2-7 MEASURING FREQUENCY AND POWER OUTPUT
4-2-8 MEASURING PULSE SHAPE AND WIDTH, RECEIVER PULLING, AND TRANSMITTER DROOP
4-2-9 MEASURING IDENTIFICATION AND MODE CODES

4-2-1 INITIAL ATC-1400 CONTROL SETTINGS FOR TRANSPONDER FUNCTION OF OPERATION

Before performing any procedures contained in this section pertaining to transponder testing, make sure all applicable test set controls are positioned as outlined below.

Some of the control settings outlined below may be changed during the course of a given procedure; all controls, however, should be reset to initial positions described below when starting a new procedure.

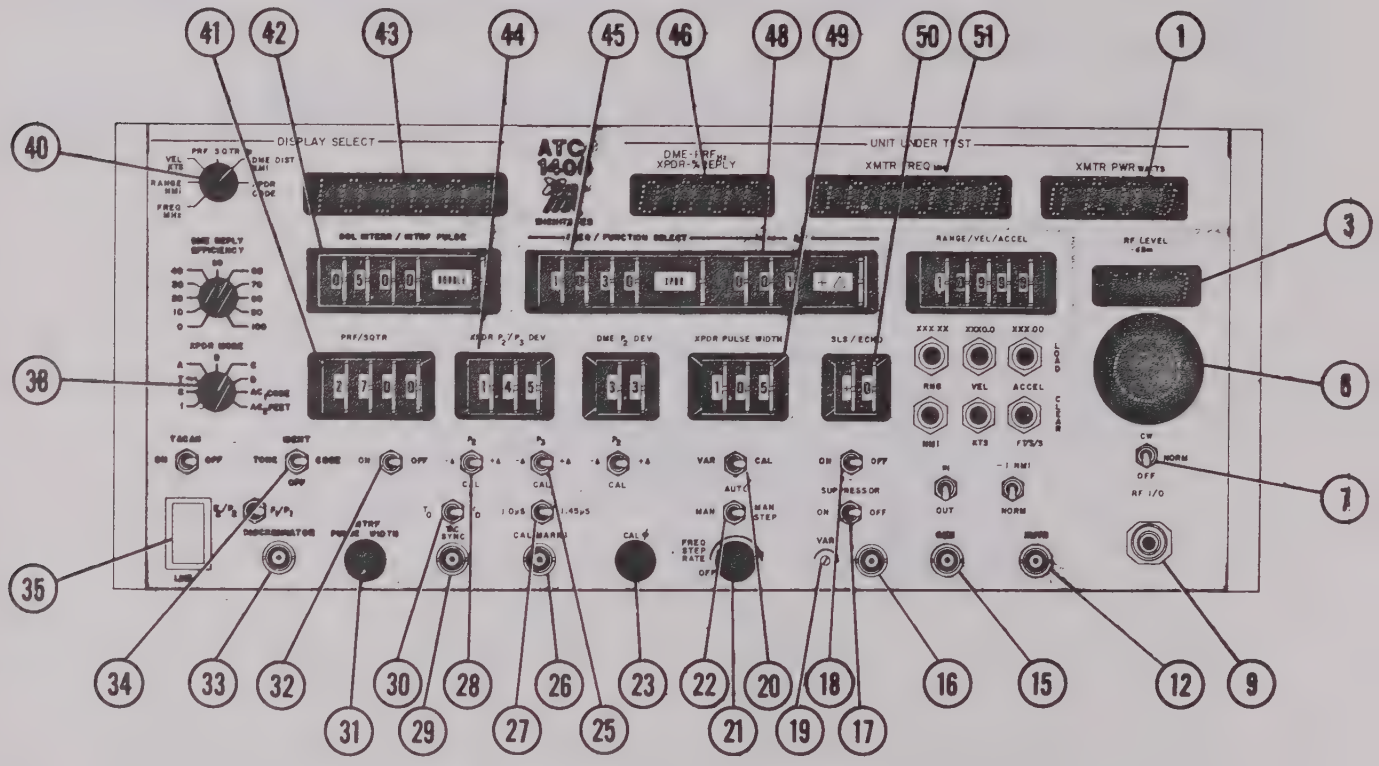


Figure 4-1 ATC-1400 FRONT PANEL CONTROLS APPLICABLE TO TRANSPONDER TESTING OPERATION

(Refer to "SECTION 3 - DESCRIPTION OF CONTROLS, CONNECTORS AND INDICATORS" for functional description of any controls used in this section.)

	CONTROL	INITIAL SETTING
6	RF LEVEL Control	"-70 dBm" Position
7	CW/NORM/OFF Switch	"NORM" Position
17	SUPPRESSOR ON/OFF Switch	"OFF" Position
18	SLS/ECHO ON/OFF Switch	"OFF" Position
20	XPDR PULSE WIDTH VAR/CAL Switch	"CAL" Position
21	FREQ STEP RATE Control	"OFF" Fully CCW Detent
22	MAN/AUTO/MAN STEP Switch	"MAN" Position
25	XPDR DEV P_3/CAL Switch	"CAL" Position
27	1.0 µs/1.45 µs Switch	"1.45 µs" Position
28	XPDR DEV P_2/CAL Switch	"CAL" Position
30	TO/TAC/TD Switch	"TD" Position
32	PRF/SQTR ON/OFF Switch	"ON" Position
34	F_2/P_2 F_1/P_1 Switch	"F_1/P_1" Position
35	LINE Switch	"OFF" Position
38	XPDR MODE Control	"A" Position
40	DISPLAY SELECT Control	"FREQ MHz" Position
41	PRF/SQTR Thumbwheels	"500 Hz"
42	DBL INTERR/INTERF PULSE Thumbwheels	"047.9 µs," "Off" Position
44	XPDR P_2/P_3 DEV Thumbwheels	"0.20 µs"
45	FREQ/FUNCTION SELECT Thumbwheels	"1030 MHz," "XPDR" Function
48	ΔF Thumbwheels	"0.00 MHz," "OFF" Position
49	XPDR PULSE WIDTH Thumbwheels	"0.00 µs" Position
50	SLS/ECHO Thumbwheels	"+0 dB" Position

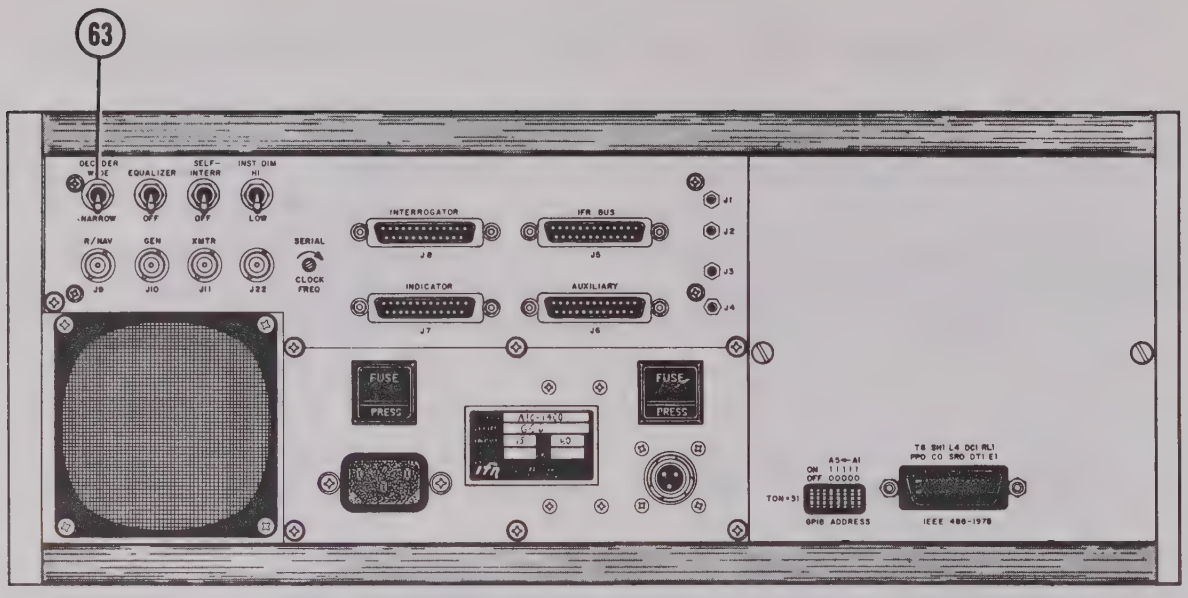


Figure 4-2 ATC-1400 REAR PANEL CONTROLS APPLICABLE TO TRANSPONDER TESTING OPERATION

(Refer to "Section 3 - DESCRIPTION OF CONTROLS, CONNECTORS, AND INDICATORS" for functional description of any controls used in this section.)

	CONTROL	INITIAL SETTING
63	DECODER WIDE/NARROW Switch	"NARROW" Position

ATC-1400 features related to transponder test operation but not requiring an initial setting:

1 XMTR PWR WATTS Display
3 RF LEVEL -dBm Display
9 RF I/O Connector
12 XMTR Connector
29 SYNC Connector
33 DISCRIMINATOR Connector
43 DISPLAY SELECT Readout
46 DME-PRF Hz XPDR - % REPLY Display
51 XMTR FREQ MHz Display

Other ACT-1400 features related to transponder test operation but not used during these test procedures:

15 GEN Connector
16 SUPPRESSOR OUTPUT Connector
19 SUPPRESSOR VAR Adjustment
23 CAL Ø Control
26 CAL MARKS Connector
31 INTERF PULSE WIDTH Control

The ATC-1400 is now ready for transponder testing operation.

4-2-2

TEST PROCEDURE: MEASURING RECEIVER BANDWIDTH AND MINIMUM THRESHOLD LEVEL (MTL)

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-3, PAGE 2-7

STEP	PROCEDURE
1.	Set ATC-1400 controls for general transponder operation as shown in Figure 4-1, Page 4-4.
2.	Apply power to ATC-1400, allow 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Place transponder (UUT) to stand-by and allow 2 minute warmup time.
5.	Place UUT Power Switch to norm Position.
6.	Verify % reply on DME-PRF Hz XPDR-% REPLY Display (46) is greater than 90%.
7.	Decrement RF LEVEL Control (6) in 1 dB steps until % reply drops below 90%.
8.	Increment RF LEVEL Control (6) 1 dB. Minimum threshold level (MTL) of UUT is now displayed on RF LEVEL-dBm display (3). Note and record this level for later reference.
9.	Increment RF LEVEL Control (6) 3 dB above level recorded in Step 8.
10.	Place ΔF Thumbwheel (48) to "+Δ" Position.
11.	Increment ΔF MHz Thumbwheels (48) in 1 MHz steps until % reply drops below 90%. Note and record generator frequency (Fhi) displayed on DISPLAY SELECT Readout (43).
12.	Place ΔF Thumbwheel (48) to "-Δ" Position.
13.	Decrement ΔF MHz Thumbwheels (48) in 1 MHz steps until % reply drops below 90%. Note and record generator frequency (Flo) displayed on DISPLAY SELECT Readout (43).

14. The 3 dB bandwidth and center frequency (Fo) can be determined by applying the formulas listed below to the values obtained in Steps 10 and 11:

(a) Center frequency - Fo = $\frac{Fhi + Flo}{2}$

(b) 3 dB bandwidth - 3 dB BW = Fhi - Flo

15. Place ΔF Thumbwheels (48) to "OFF" Position.

16. Increment RF Level Control (6) to increase level +17 dB above level obtained in Step 9.

17. Place ΔF Thumbwheel (48) to "+Δ" Position.

18. Increment ΔF MHz Thumbwheels (48) in 1 MHz steps until % reply drops below 90%. Note and record frequency (Fhi) displayed on DISPLAY SELECT Readout (43).

19. Place ΔF Thumbwheel (48) to "-Δ" Position.

20. Decrement ΔF MHz Thumbwheels (48) until % reply drops below 90%. Note and record frequency (Flo) displayed on DISPLAY SELECT Readout (43).

21. The 20 dB bandwidth can be determined by applying the formula listed below to the values obtained in Steps 17 and 19.

20 dB BW = Fhi - Flo

22. Set ΔF Thumbwheel (48) to "OFF" Position.

4-2-3

TEST PROCEDURE: MEASURING SIDE LOBE SUPPRESSION (SLS)

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-3, PAGE 2-7

STEP	PROCEDURE
1.	Set ATC-1400 controls for general transponder operation as shown in Figure 4-1, Page 4-4.
2.	Apply power to ATC-1400, allow 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Place transponder (UUT) to stand-by, allow 2 minute warm-up time, then place to norm Position.
5.	Verify % reply on DME-PRF Hz XPDR - % REPLY Display (46) is 100%.
6.	Decrement RF LEVEL Control (6) in 1 dB steps until % reply drops below 90%.
7.	Increment RF LEVEL Control (6) 1 dB. Minimum threshold level (MTL) is now displayed on RF LEVEL -dBm Display (3). Note and record this level for later reference.
8.	Set RF LEVEL CONTROL (6) +3 dB above MTL established in Step 7.
9.	Place SLS/ECHO ON/OFF Switch (18) to "ON" Position.
10.	Increase RF output using RF LEVEL Control (6) in 10 dB steps to insure a zero % reply rate up to +50 dB above MTL.
11.	Set RF LEVEL Control (6) to +3 dB above MTL established in Step 7.
12.	Place SLS/ECHO Thumbwheels (50) to "-9" dB Position.
13.	Increase RF output using RF LEVEL Control (6) in 10 dB steps to insure a 100% reply rate up to +50 dB above MTL.

14. Set RF LEVEL Control (6) to +3 dB above MTL established in Step 7.

15. Place SLS/ECHO ON/OFF Switch (18) to "OFF" Position.

16. Increase RF output using RF LEVEL Control (6) in 10 dB steps to insure % reply rate does not drop below 90% for a level of +50 dB above MTL established in Step 6.

4-2-4

TEST PROCEDURE: MEASURING PULSE DEVIATION

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-3, PAGE 2-7

STEP	PROCEDURE
1.	Set ATC-1400 controls for general transponder operation as shown in Figure 4-1, Page 4-4.
2.	Apply power to ATC-1400 allow 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Place transponder (UUT) to stand-by, allow 2 minutes warm-up time, then place UUT to norm Position.
5.	Verify % reply on DME-PRF Hz XPDR - % REPLY Display (46) is 100%.
6.	Decrement RF LEVEL Control (6) in 1 dB steps until % reply drops below 90%.
7.	Increment RF LEVEL Control (6) 1 dB. Minimum threshold level (MTL) of UUT is now displayed on RF LEVEL - dBm Display (3). Note and record this level for later reference.
8.	Place XPDR DEV P_3/CAL Switch (25) to "+Δ" Position.
9.	Increase RF output using RF LEVEL Control (6) in 10 dB steps to verify % reply rate does not drop below 90% for a level of +50 dB above MTL established in Step 6.
10.	Place XPDR P_3/CAL Switch (25) to "-Δ" Position.
11.	Decrease RF output using RF LEVEL Control (6) in 10 dB steps to MTL and verify % reply rate does not drop below 90% for a level of +50 dB above MTL, down to MTL established in Step 7.
12.	Place XPDR P_2/P_3 DEV Thumbwheels (44) to "1.05 μs" Position.
13.	Set RF LEVEL Control (6) to MTL established in step 7.

14. Increase RF output using RF LEVEL Control (6) in 10 dB steps to +50 dB above MTL and verify % reply rate on DME-PRF Hz XPDR - % REPLY Display (46) is less than 10%.

15. Place XPDR P_3/CAL Switch (25) to "+Δ" Position.

16. Verify % reply on DME-PRF Hz XPDR - % REPLY Display (44) is less than 10%.

17. Decrease RF output using RF LEVEL Control (6) in 10 dB steps down to MTL and verify % reply rate on DME - PRF Hz XPDR - % REPLY Display (46) is less than 10%.

18. Place XPDR DEV P_3/CAL Switch to "CAL" Position.

4-2-5

TEST PROCEDURE: VERIFICATION OF INTERROGATOR RECOVERY TIME

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-3, PAGE 2-7

STEP	PROCEDURE
1.	Set ATC-1400 controls for general transponder operation as shown in Figure 4-1, Page 4-4.
2.	Apply power to ATC-1400, allow 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Place transponder (UUT) to stand-by, allow 2 minutes warm-up time, then place to norm Position.
5.	Verify % reply on DME-PRF Hz XPDR - % REPLY Display (46) is 100%.
6.	Decrement RF LEVEL Control (6) in 1 dB steps until % reply drops below 90%.
7.	Increment RF LEVEL Control (6) 1 dB. Minimum threshold level (MTL) of UUT is now displayed on RF LEVEL -dBm Display (3). Note and record this level for later reference.
8.	Set RF LEVEL Control (6) to +3 dB above MTL established in Step 6.
9.	Place SLS/ECHO ON/OFF Switch (18) to "ON" Position.
10.	Place DBL INTERR/INTERF PULSE Thumbwheels (42) to "047.9 DOUBLE" Position.
11.	Verify % reply displayed on DME-PRF Hz XPDR - % REPLY Display (46) is 50%.
12.	Place SLS/ECHO ON/OFF Switch (18) to "OFF" Position.
13.	Place DBL INTERR/INTERF PULSE Thumbwheels (42) to "125.0 DOUBLE" Position.

14. Verify % reply displayed on DME-PRF Hz XPDR - % REPLY Display (46) is greater than 90%.

15. Place DBL INTERR/INTERF PULSE Thumbwheels (45) to "OFF" Position.

4-2-6

TEST PROCEDURE: PULSE WIDTH DECODER OPERATION

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-3, PAGE 2-7

STEP	PROCEDURE
1.	Set ATC-1400 controls for general transponder operation as shown in Figure 4-1, Page 4-4.
2.	Apply power to ATC-1400, allow 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Place transponder (UUT) to stand-by, allow 2 minutes warm-up time, then place to norm Position.
5.	Verify % reply on DME-PRF Hz XPDR - % REPLY Display (46) is 100%.
6.	Decrement RF LEVEL Control (6) in 1 dB steps until % reply drops below 90%.
7.	Increment RF LEVEL Control (6) 1 dB. Minimum threshold level (MTL) of UUT is now displayed on RF LEVEL -dBm Display (3). Note and record this level for later reference.
8.	Place XPDR PULSE WIDTH Thumbwheels (49) to "0.25 μs" Position, XPDR PULSE WIDTH VAR/CAL Switch (20) to "VAR" Position, and verify % reply displayed on DME-PRF Hz XPDR - % REPLY Display (46) is less than 10%.
9.	Increase RF output using RF LEVEL Control (6) in 10 dB steps to +50 dB above MTL and verify % reply rate on DME-PRF Hz XPDR - % REPLY Display (46) is less than 10%.
10.	Place XPDR PULSE WIDTH Thumbwheels (49) to "1.55 μs" Position, and verify % reply displayed on DME-PRF Hz XPDR - % REPLY Display (46) is less than 10%.
11.	Decrease RF output using RF LEVEL Control (6) in 10 dB steps to MTL and verify % reply rate on DME-PRF Hz XPDR - % REPLY Display (46) is less than 10%.

4-2-7

TEST PROCEDURE: MEASURING FREQUENCY AND POWER OUTPUT

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-3, PAGE 2-7

STEP	PROCEDURE
1.	Set ATC-1400 controls for general transponder operation as shown in Figure 4-1, Page 4-4.
2.	Apply power to ATC-1400, allow 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Place transponder (UUT) to stand-by, allow 2 minutes warm-up time, then place to norm Position.
5.	Verify UUT transmitter frequency (F_1) of 1090 MHz (±3 MHz) is displayed on XMTR FREQ MHz Display (51). Note and record transmitter frequency (F_{F1}) for later reference.
6.	Verify UUT transmitter power output (P_1) displayed on XMTR PWR WATTS Display (1) is within manufacturer's specifications. Note and record power output (P_{F1}) for later reference.
7.	Place F_2/P_2 F_1/P_1 Switch (34) to "F_2/P_2" Position.
8.	Verify UUT transmitter frequency (F_2) of 1090 MHz (±3 MHz) is displayed on XMTR FREQ MHz Display (51). Note and record transmitter frequency (F_{F2}) for later reference.
9.	Verify UUT transmitter power output (P_2) displayed on XMTR PWR WATTS Display (1) is within manufacturer's specifications. Note and record power output (P_{F2}) for later reference.
10.	ΔF can be determined by applying the formula listed below to the values obtained in Steps 5 and 8 above. (a) $\Delta F = F_{F1} - F_{F2}$ (ΔF should be less than 3 MHz)

11. ΔP can be determined by applying the formula listed below to the values obtained in Steps 7 and 10 above.

(a) $\Delta P = 10 \log \frac{(P_{F_1})}{(P_{F_2})}$

(ΔP should be less than 1 dB)

4-2-8

TEST PROCEDURE: MEASURING PULSE SHAPE AND WIDTH, TRANSMITTER DROOP, AND FREQUENCY PULLING

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: OSCILLOSCOPE

TEST SET-UP DIAGRAM: FIGURE 2-3, PAGE 2-7

STEP	PROCEDURE
1.	Set ATC-1400 controls for general transponder operation as shown in Figure 4-1, Page 4-4.
2.	Apply power to ATC-1400, allow 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Place transponder (UUT) to stand-by, allow 2 minutes warm-up time, then place to norm Position.
5.	Using three coax cables terminated into a 50Ω load through a BNC TEE Connector, connect oscilloscope CH-A to ATC-1400 XMTR Connector (12), CH-B DISCRIMINATOR Connector (33) and scope sync to ATC-1400 SYNC Connector (29).
6.	Measure UUT reply delay from leading edge of P_3 pulse to leading edge of F_1 pulse. Note and record measured delay (i.e. D_1) and verify D_1 = 3.0 µs (±0.5 µs).
7.	Place XPDR MODE Control (38) to "C" Position and measure UUT reply delay from leading edge of P_3 pulse to leading edge of F_1 pulse. Note and record measured delay (i.e. D_2) and verify D_2 = 3.0 µs (±0.5 µs).
8.	Substract D_1 from D_2 and verify difference in delay from Mode A to Mode C is less than ±0.2 µs. Replace XPDR MODE Control (38) to "A" Position.
9.	Sync oscilloscope to leading edge of F_1 pulse to obtain a stable trace on display (using oscilloscope internal sync).
10.	Verify on Ch-A of oscilloscope that UUT reply train pulse width has a rise time of .05 µs to .1 µs and a fall time of .05 µs to .2 µs, measured between the 90% and 10% amplitude points. Also verify the pulse shape is .35 µs to .55 µs, measured at the 50% amplitude point.

NOTE

- See Appendix J for baseline setting using ATC-1400 XMTR detected output.

11. Verify amplitude of pulses between the F_1 and F_2 framing pulse are within the amplitude of F_1 and F_2 with exception of the X pulse.

Example:

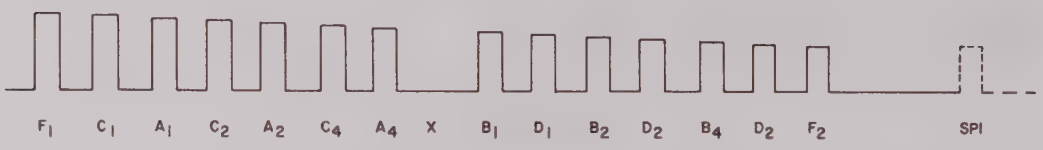


Figure 4-3 Transmitter Droop

12. Verify the SPI pulse width and shape is within specifications as outlined in Step 10 and amplitude of the SPI pulse is within 12% of F_1 framing pulse.

13. Place PRF/SQTR Thumbwheels (41) to "1200 Hz" Position, verify the SPI pulse width and shape is within specifications as outlined in Step 10 and amplitude of the SPI pulse is within 12% of F_1 framing pulse.

14. Place PRF/SQTR Thumbwheels (41) to "500 Hz" Position.

15. Observe discriminator output on Ch-B of oscilloscope and verify all pulses are within the levels of the F_1 and F_2 framing pulse. For pulses not within the specified range, measure the voltage difference between the reference line and the pulse (ΔE). To determine frequency of pulse, use formulas listed in example below.

NOTE

- Using vertical position control on oscilloscope, align F_1 or F_2 framing pulse on major horizontal axis depending on position of F_2/P_2 F_1/P_1 Switch, as shown in examples below:

Examples:

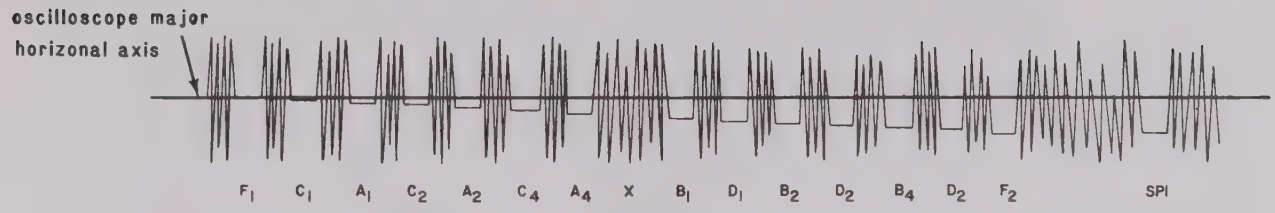


Figure 4-4 Transmitter Frequency Pull F_1/P_1

Waveform shown above is for F_2/P_2 F_1/P_1 Switch in "F_1/P_1" Position.

Apply pulse voltage to following formula to determine frequency: $F = F_{F1} + \frac{\Delta E}{G}$ $G = \frac{.5V}{MHz}$ into a 50 Ohm load

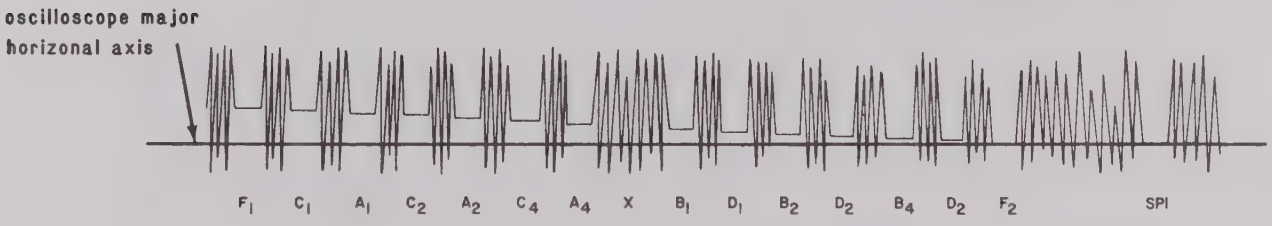


Figure 4-5 Transmitter Frequency Pull F_2/P_2

Waveform shown above is for F_2/P_2 F_1/P_1 Switch in "F_2/P_2" Position.

Apply pulse voltage to following formula to determine frequency: $F = F_{F2} + \frac{\Delta E}{G}$ $G = \frac{.5V}{MHz}$ into a 50 Ohm load

4-2-9

TEST PROCEDURE: MEASURING IDENTIFICATION AND MODE CODES.

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-3, PAGE 2-7

STEP	PROCEDURE
1.	Set ATC-1400 controls for general transponder operation as shown in Figure 4-1, Page 4-4.
2.	Place DISPLAY SELECT Control (40) to "XPDR CODE" Position.
3.	Apply power to ATC-1400, allow 5 minute warm-up period.
4.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
5.	Place transponder (UUT) to stand-by, allow 2 minutes warm-up time, then place to norm Position.
6.	Verify the letter "F" is not displayed on DISPLAY SELECT READOUT (43). With 7777 set on UUT, verify ATC-1400 DISPLAY SELECT Readout (43) is "7777".
7.	Enable the squawk ident function of UUT and verify UUT ID Code is displayed on DISPLAY SELECT Readout (43) (IDXXXX).
8.	Step thru UUT Mode A Codes and verify correct code is displayed on DISPLAY SELECT Readout (43).
9.	Place XPDR MODE Control (38) to "C" Position.
10.	Enable C Mode operation on UUT.
11.	Step thru UUT Mode C Codes and verify correct code is displayed on DISPLAY SELECT Readout (43).
12.	Place XPDR MODE Control (38) to "AC FEET" Position.
13.	Set UUT Altitude reporting code C to position one and all other bits to zero, and verify ATC-1400 DISPLAY SELECT Readout (43) indicates "C1.0".

14. Set UUT Altitude reporting code $A_1A_2A_4B_1B_2B_4C_1C_2D_2D_4$ to position one and all other bits to zero, and verify ATC-1400 DISPLAY SELECT Readout (43) indicates "ID84.1".

15. Set UUT Altitude reporting code C_4D_2 to position one, all other bits to zero and verify ATC-1400 DISPLAY SELECT Readout (43) indicates "126.7".

4-3 DME EXAMPLE TEST PROCEDURES

The step-by-step test procedures outlined in this section are for general application of the ATC-1400 for testing DME (distance measuring equipment) and DME Indicators. Reference should be made to the DME manufacturer's instruction manual covering the particular equipment under test for complete test procedures.

The procedures in this section are examples used to illustrate the operation of the ATC-1400 and as such are not intended to supersede or modify the manufacturer's recommended test or intended to include all test necessary to certify DME equipment. Specifications called out in the following example procedures are for illustration purposes only and therefore do not apply to any specific models of DME equipment.

The example procedures contained in this section are:

4-3-2 MEASURING DME TRANSMITTER FREQUENCY AND POWER
4-3-3 MEASURING TRANSMITTER PULSE CHARACTERISTICS
4-3-4 MEASURING RECEIVER MEMORY TIME
4-3-5 MEASURING RECEIVER BANDWIDTH AND SENSITIVITY
4-3-6 MEASURING PULSE POSITION DECODER ACCURACY
4-3-7 ADJACENT CHANNEL TEST
4-3-8 MEASURING ACCURACY AND TRACKING
4-3-9 MEASURING ACQUISITION TIME
4-3-10 MEASURING ECHO AND CO-CHANNEL PERFORMANCE

4-3-1 INITIAL ATC-1400 CONTROL SETTING FOR DME FUNCTION OF OPERATION

Before performing any procedures contained in this section pertaining to DME testing, make sure all applicable test set controls are positioned as outlined below.

Some of the control settings outlined below may be changed during the course of a given procedure; all controls, however, should be reset to initial positions described below when starting a new procedure.

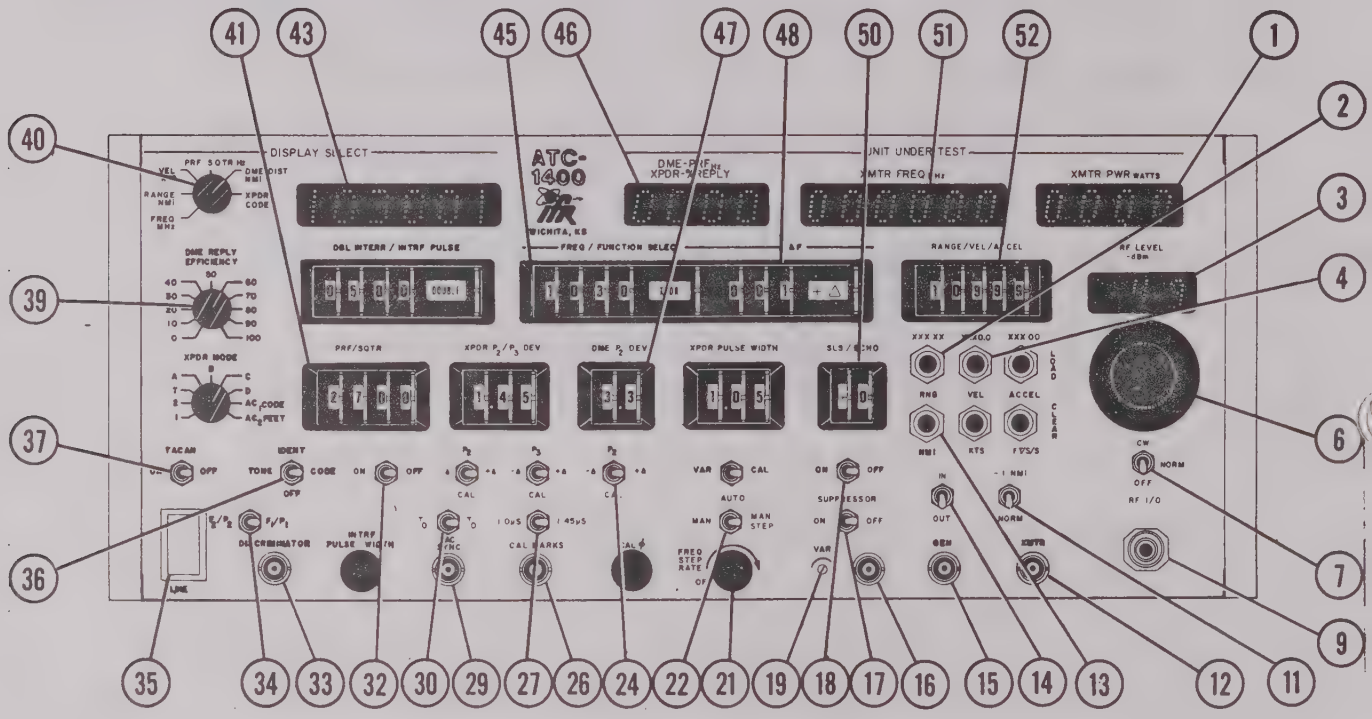


Figure 4-6 ATC-1400 FRONT PANEL CONTROLS APPLICABLE TO DME TESTING OPERATION

(Refer to "SECTION 3 - DESCRIPTION OF CONTROLS, CONNECTORS, AND INDICATORS" for functional description of any controls used in this section.)

	CONTROL	INITIAL SETTING
6	RF LEVEL Control	"-48 dBm" Position
7	CW/NORM/OFF Switch	"NORM" Position
11	-1 NMI/NORM Switch	"NORM" Position
14	IN/OUT Switch	"OUT" Position
17	SUPPRESSOR ON/OFF Switch	"OFF" Position
18	SLS/ECHO ON/OFF Switch	"OFF" Position
21	FREQ STEP RATE Control	"OFF" Fully CCW, Detent Position
22	MAN/AUTO/MAN STEP Switch	"MAN" Position
24	DME DEV P_2/CAL Switch	"CAL" Position
27	1.0 µs/1.45 µs Switch	"1.0 µs" Position
30	TO/TAC/TD Switch	"TØ" Position
32	PRF/SQTR ON/OFF Switch	"ON" Position
34	F_2/P_2 F_1/P_1 Switch	"F_1/P_1" Position
35	LINE Switch	"OFF" Position
36	IDENT TONE/OFF/CODE Switch	"OFF" Position
37	TACAN ON/OFF Switch	"OFF" Position
39	DME REPLY EFFICIENCY Switch	"70%" Position
40	DISPLAY SELECT Control	"FREQ MHz" Position
41	PRF/SQTR Thumbwheels	"2700 Hz"
45	FREQ/FUNCTION SELECT Thumbwheels	"108.00 MHz," "VOR PAIR" Position
47	DME P_2 DEV Thumbwheels	"0.5 µs" Position
48	ΔF Thumbwheels	"0.00 MHz," "OFF" Position
50	SLS/ECHO Thumbwheels	"-8 dB" Position
52	RANGE/VEL/ACCEL Thumbwheels	"04000" Position

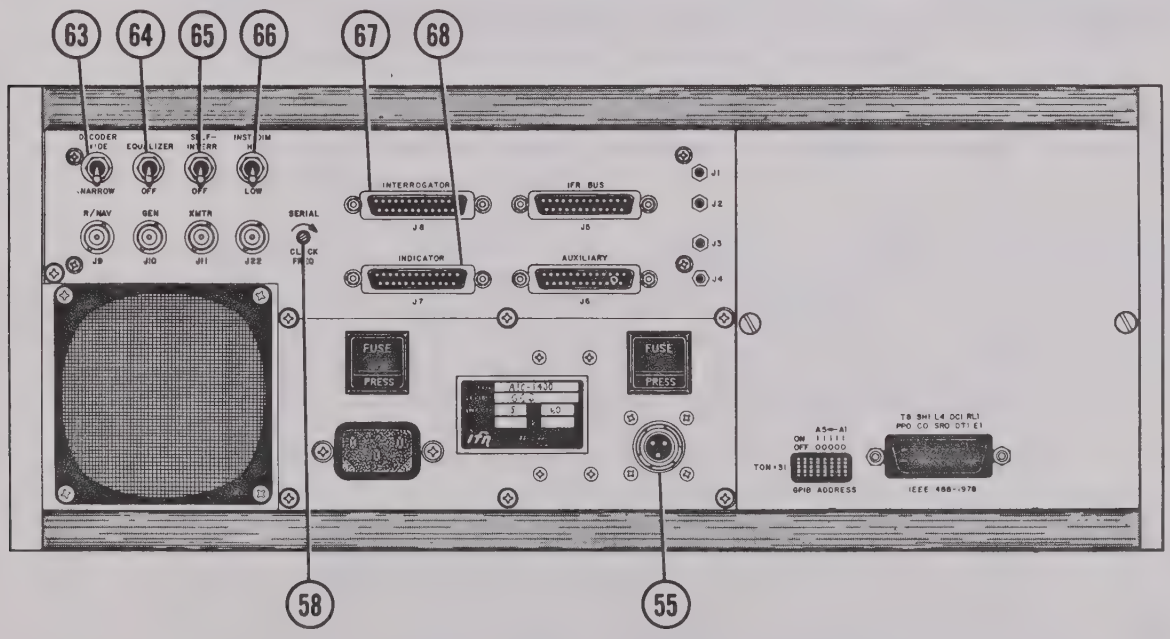


Figure 4-7 ATC-1400 REAR PANEL CONTROLS APPLICABLE TO DME TESTING OPERATION

(Refer to "Section 3 - DESCRIPTION OF CONTROLS, CONNECTORS, AND INDICATORS" for functional description of any controls used in this section.)

	CONTROLS	INITIAL SETTINGS
63	DECODER WIDE/NARROW Switch	"NARROW" Position
64	EQUALIZER/OFF Switch	"ON" Position
65	SELF-INTERR/OFF Switch	"OFF" Position

ATC-1400 features related to DME test operation but not requiring an initial setting:

1	XMTR PWR WATTS Display	13	CLEAR RNG Push-button Switch
2	LOAD RNG Push-button Switch	26	CAL MARKS Connector
3	RF LEVEL -dBm Display	29	SYNC Connector
4	LOAD VEL Push-button Switch	43	DISPLAY SELECT Readout
9	RF I/O Connector	46	DME-PRF Hz XPDR - % REPLY Display
12	XMTR Connector	51	XMTR FREQ MHz Display
		67	INTERROGATOR Connector (J8)

Other ATC-1400 features related to DME test operation but not used during these test procedures.

15	GEN Connector	55	115 V, 100 Hz INDICATOR Connector
16	SUPPRESSOR OUTPUT Connector	58	SERIAL CLOCK FREQ Adjustment
19	SUPPRESSOR VAR Adjustment	66	INST DIM HI/LOW Switch
33	DISCRIMINATOR Connector	68	INDICATOR Connector (J7)

The ATC-1400 is now ready for DME testing operation.

4-3-2

TEST PROCEDURE: MEASURING DME TRANSMITTER FREQUENCY AND POWER

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: SPECTRUM ANALYZER
60 dB PAD

TEST SET-UP DIAGRAM: FIGURE 2-2, PAGE 2-6

STEP	PROCEDURE
1.	Set ATC-1400 controls for general DME operation as shown in Figure 4-6, Page 4-26 and Figure 4-7, Page 4-27.
2.	Apply power to ATC-1400, allow a 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Place DME (UUT) to stand-by, allow 2 minute warm-up time, then place to norm Position.
5.	Verify internal frequency counter value on DISPLAY SELECT Readout (43) is 978.00 MHz (±.02 MHz). Increment or decrement ΔF Thumbwheels (48) in a positive or negative direction if necessary, to obtain correct frequency.
6.	Momentarily depress CLEAR RNG Push-button Switch (13) to clear test set of any previously loaded range, velocity and acceleration information.
7.	Observe UUT transmitter frequency on XMTR FREQ MHz Display (51). Note and record XMTR frequency (F_{P1}) for later reference. (F_{P1} = 1041 MHz ± .07 MHz)
8.	Verify UUT transmitter power displayed on XMTR PWR WATTS Display (1) is within manufacturers specifications.
9.	Place F_1/P_1 F_2/P_2 Switch (34) in "F_2/P_2" Position.
10.	Verify UUT transmitter frequency on XMTR FREQ MHz Display (51). Note and record frequency (F_{P2}) for later reference. (F_{P2} = 1041 MHz ± .07 MHz)
11.	Verify UUT transmitter displayed power on XMTR PWR WATTS Display (1) is within manufacturers specifications.

12. To determine frequency stability of UUT, apply results of Steps 8 and 11 to the following formula:

$$100 \left(1 - \frac{Fp_1}{Fp_2}\right) = \% \text{ FREQUENCY STABILITY}$$

Verify the Frequency Stability of UUT transmitter is within (±0.0007%).

13. Connect output of UUT to a spectrum analyzer, through a 60 dB pad and verify 90% of transmitted power falls within (±0.5 MHz) of assigned channel frequency.

14. Place F_1/P_1 F_2/P_2 Switch (34) in "F_1/P_1" Position.

15. Connect output of UUT to RF I/O Connector (9) of ATC-1400.

16. Place FREQ/FUNCTION SELECT Thumbwheels (45) to "117.90 MHz", "VOR PAIR" Position.

17. Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.

18. Perform procedures in Steps 7 through 14.

19. Repeat Steps 6 thru 14 for three other channels picked at random to assure proper operation and frequency stability of UUT. (For best results, select two "X" channels and two "Y" channels for testing.)

4-3-3

TEST PROCEDURE: MEASURING TRANSMITTER PULSE CHARACTERISTICS

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: OSCILLOSCOPE

TEST SET-UP DIAGRAM: FIGURE 2-2, PAGE 2-6

STEP	PROCEDURE
1.	Set ATC-1400 controls for general DME operation as shown in Figure 4-6, Page 4-26 and Figure 4-7, Page 4-27.
2.	Apply power to ATC-1400, allow a 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Place DME (UUT) to stand-by, allow 2 minutes warm-up time, then place to norm Position.
5.	Verify internal frequency counter value on DISPLAY SELECT Readout (43) is 978.00 MHz (.02 MHz). Increment or decrement F Thumbwheels (48) in a positive or negative direction if necessary, to obtain correct frequency.
6.	Momentarily depress CLEAR RNG Push-button Switch (13) to clear test set of any previously loaded range, velocity and acceleration information.
7.	Connect a BNC TEE Connector to Ch-A of oscilloscope.
8.	Connect a 50 dummy load to one end of BNC TEE Connector and a 50 coax cable from the other end of the BNC TEE Connector to the ATC-1400 XMTR Connector (12).
9.	Connect 50 coax cable from oscilloscope EXT Trigger to ATC-1400 SYNC Connector (29).

NOTE

- If viewing all of P pulse is desired, remove the oscilloscope EXT trigger coax from ATC-1400 SYNC Connector (29) and connect it to the UUT suppression output.

10. Verify UUT transmitted pulse rise and fall time to be less than 3.0 µs, and the pulse width measured from between the leading and trailing edges of the pulse is 3.5 µs (±0.5 µs).

NOTE

- See Appendix J for baseline setting using ATC-1400 XMTR detected output.

11. Verify lock mode pulse repetition frequency (PRF) to be no greater than 30 pp/s.

12. Place DME REPLY EFFICIENCY Control (39) to "0%" Position and allow ATC-1400 a 15-second interval to come out of memory.

13. Verify search mode PRF is in accordance to manufacturers specifications but no greater than 150 pp/s.

14. Place DME REPLY EFFICIENCY Control (39) to "70%" Position.

15. Place FREQ/FUNCTION SELECT Thumbwheels (45) to "5 VOR" Position.

16. Repeat procedures in Steps 10 thru 15.

4-3-4

TEST PROCEDURE: MEASURING RECEIVER MEMORY TIME

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: Stopwatch

TEST SET-UP DIAGRAM: FIGURE 2-2, PAGE 2-6

STEP	PROCEDURE
1.	Set ATC-1400 controls for general DME operation as shown in Figure 4-6, Page 4-26 and Figure 4-7, Page 4-27.
2.	Apply power to ATC-1400, allow a 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Verify internal frequency counter value on DISPLAY SELECT Readout (43) is 978.000 MHz (.02 MHz). Increment or decrement F Thumbwheels (48) in a positive or negative direction if necessary, to obtain correct frequency.
5.	Momentarily depress CLEAR RNG Push-button Switch (13) to clear test set of any previously loaded range, velocity and acceleration information.
6.	Place DME (UUT) to stand-by, allow 2 minute warm-up period, then place to norm Position and wait for a lock-on condition.
7.	Using a stopwatch, record elapsed time from the instant DME REPLY EFFICIENCY Control (39) is placed in the "0%" Position and DME-PRF XPDR - % REPLY Display (46) reflects an increase of the UUT PRF. Verify elapsed time to be 8 seconds (4 seconds).
8.	Place RANGE/VEL/ACCEL Thumbwheels (52) to "400" KTS Position.
9.	Place DME REPLY EFFICIENCY Control (39) to "70" % Position, momentarily depress CLEAR RNG Push-button Switch (13) and LOAD VEL Push-button Switch (4). Allow UUT to lock-on and track.
10.	Select 0% reply rate on DME REPLY EFFICIENCY Control (39) and allow an interval of 8 seconds (4 seconds) for ATC-1400 to come out of memory, then select 70% reply position. Verify distance inaccuracy to be no more than 0.2 nmi.

11. Place RANGE/VEL/ACCEL Thumbwheels (52) to "1000" KTS Position and repeat procedures in Steps 10 and 14.

4-3-5

TEST PROCEDURE: MEASURING RECEIVER BANDWIDTH AND SENSITIVITY

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-2, PAGE 2-6

STEP	PROCEDURE
1.	Set ATC-1400 controls for general DME operation as shown in Figure 4-6, Page 4-26 and Figure 4-7, Page 4-27.
2.	Apply power to ATC-1400, allow a 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Verify internal frequency counter value on DISPLAY SELECT Readout (43) is 978.000 MHz (.02 MHz). Increment or decrement F Thumbwheels (48) in a positive or negative direction if necessary, to obtain correct frequency.
5.	Momentarily depress CLEAR RNG Push-button Switch (13) to clear test set of any previously loaded range, velocity and acceleration information.
6.	Place DME (UUT) to stand-by, allow 2 minute warm-up period, then place to norm Position.
7.	Place RF LEVEL Control (6) to "-79 dBm" as displayed on RF LEVEL -dBm Display (3).
8.	Decrease RF LEVEL Control (6) in 1 dB steps, pausing 10 to 15 seconds between steps until UUT breaks lock-on condition and starts search.
9.	Increase RF LEVEL Control (6) by 1 dB. RF LEVEL -dBm Display (3) now displays track sensitivity. Note and record this level for later reference.
10.	Place IDENT TONE/OFF/CODE Switch (36) to "CODE" Position to verify a clear modulated tone with Morse code "IFR." If tone is garbled, increase RF level until the code is clear and useful. This is receiver sensitivity level, which should be less than or equal to -90 dBm.

Place FREQ/FUNCTION SELECT Thumbwheels (45) to "117.90 MHz" (DME (UUT) receive frequency 1213 MHz) "VOR PAIR" Position, and perform procedures outlined in Steps 8 thru 10 above.

Place IDENT TONE/OFF/CODE Switch (36) to "OFF" Position.

Place DISPLAY SELECT Control (40) to "FREQ MHz" Position, and FREQ/FUNCTION SELECT Thumbwheels (45) to +ΔF Position.

Increment ΔF Thumbwheels (48) until frequency displayed on DISPLAY SELECT Readout (43) is the assigned channel frequency plus receiver frequency stability of .06 MHz.

Repeat procedures in Steps 7 thru 11, and verify results to be less than or equal to -90 dBm.

Decrement ΔF Thumbwheels (48) until frequency displayed on DISPLAY SELECT Readout (43) is the assigned channel frequency minus receiver frequency stability of .06 MHz.

Repeat procedures in Steps 7 thru 11, and verify results to be less than or equal to -90 dBm.

Repeat procedures outlined in Steps 7 thru 16 for three other channels picked at random to assure proper receiver sensitivity of UUT. (For best results, select two "X" Channels and two "Y" Channels for testing.)

NOTE

- Perform the following steps for DME's connected to the ATC-1400 Rear Panel INTERROGATOR Connector (J8) (66) which are automatically channeled using the 2 out of 5 code.

Place FREQ/FUNCTION SELECT Thumbwheels (45) to "0001 TAC X" Position, IDENT TONE ON/OFF CODE Switch (36) to "TONE" Position, RF LEVEL Control (6) to the threshold established in Step 11, MAN/AUTO/MAN STEP Switch (22) to "AUTO" Position and FREQ STEP RATE Control (21) for maximum channeling delay of UUT in accordance to manufacturers specifications. Verify a clear IDENT Tone for all TACAN "X" Channels.

Place FREQ/FUNCTION Select Thumbwheels (45) to "0001 TAC Y" Position. Momentarily place MAN/AUTO/MAN STEP Switch (22) in "MAN" Position than back to "AUTO" Position to initiate automatic channel stepping and verify a clear IDENT Tone for all TACAN "Y" Channels.

4-3-6

TEST PROCEDURE: MEASURING PULSE POSITION DECODER ACCURACY

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-2, PAGE 2-6

STEP	PROCEDURE
1.	Set ATC-1400 controls for general DME operation as shown in Figure 4-6, Page 4-26 and Figure 4-7, Page 4-27.
2.	Apply power to ATC-1400, allow a 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Verify internal frequency counter value on DISPLAY SELECT Readout (43) is 978.000 MHz (.02 MHz). Increment or decrement F Thumbwheels (48) in a positive or negative direction if necessary, to obtain correct frequency.
5.	Momentarily depress CLEAR RNG Push-button Switch (13) to clear test set of any previously loaded range, velocity and acceleration information.
6.	Place DISPLAY SELECT Control (40) to "DME DIST NMi" Position.
7.	Place DME (UUT) to stand-by, allow 2 minute warm-up period, then place to norm Position.
8.	Place RF LEVEL Control (6) to "-79 dBm" as displayed on RF LEVEL -dBm Display (3).
9.	Increase RF LEVEL Control (6) by 1 dB. RF LEVEL -dBm Display now displays track sensitivity. Note and record this level for later reference.
10.	Place Ident TONE/OFF/CODE Switch (36) to "CODE" Position to verify a clear modulated tone with morse code "IFR". If tone is garbled increase RF Level until the code is clear and useful. This is the receiver sensitivity level which should be less than or equal to -90 dBm.
11.	Momentarily depress LOAD RNG Push-button Switch (2) to load previously selected range of 40 nmi in test set. Wait 15 seconds for UUT to obtain lock-on.

12. Place DME DEV P_2/CAL Switch (24) to "+Δ" Position, pause for duration of memory time and verify UUT does not break lock-on condition. Verify range displayed on DISPLAY SELECT Readout (43) is 040.00 (±1.2 nmi).

13. Place DME DEV P_2/CAL Switch (24) to "-Δ" Position, pause for duration of memory time and verify UUT does not break lock-on condition. Verify range displayed on DISPLAY SELECT Readout (43) is 040.00 (±1.2 nmi).

14. Rotate RF LEVEL Control (6) until "-20 dBm" is displayed on RF LEVEL -dBm Display (3) and perform procedures in Steps 12 and 13 above.

15. Repeat Steps 9, 10 and 11 above to establish previous set receiver sensitivity level.

16. Place DME P_2 DEV Thumbwheels (47) to "6.0 μs" Position, pause for duration of memory time and verify UUT breaks lock-on condition.

17. Place DME P_2/CAL Switch (24) to "CAL" Position, pause for duration of memory time and verify UUT lock-on condition.

18. Place DME P_2/CAL Switch (24) to "+Δ" Position, pause for duration of memory time and verify UUT breaks lock-on condition.

19. Set RF LEVEL Control (6) to "-48 dBm" Position, DME P_2 DEV/CAL Switch (24) to "CAL" Position, pause for duration of memory time and verify UUT lock-on condition.

20. Repeat procedures in Steps 16 and 17 above.

21. Place DME P_2 DEV Thumbwheels (47) to "0.5 μs" Position.

22. Place FREQ/FUNCTION SELECT Thumbwheels (45) to "108.05 MHz (DME (UUT) receive frequency 983.00 MHz) Position and repeat procedures in Steps 12, 13, 16, 17 and 18 above.

4-3-7

TEST PROCEDURE: ADJACENT CHANNEL TEST

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-2, PAGE 2-6

STEP	PROCEDURE
1.	Set ATC-1400 controls for general DME operation as shown in Figure 4-6, Page 4-26 and Figure 4-7, Page 4-27.
2.	Apply power to ATC-1400, allow a 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-1, pg. 4-2.
4.	Verify internal frequency counter value on DISPLAY SELECT Readout (43) is 978.000 MHz (.02 MHz). Increment or decrement F Thumbwheels (48) in a positive or negative direction if necessary, to obtain correct frequency.
5.	Momentarily depress CLEAR RNG Push-button Switch (13) to clear test set of any previously loaded range, velocity and acceleration information.
6.	Place DISPLAY SELECT Control (40) to "FREQ MHz" Position.
7.	Place DME (UUT) to stand-by, allow 2 minute warm-up period, then place to norm Position.
8.	Place F Thumbwheels to "+ F" Position.
9.	Adjust F Thumbwheels (48) to obtain a displayed frequency of +0.94 MHz above the assigned channel frequency displayed on DISPLAY SELECT Readout (43).
10.	Place RF LEVEL Control (6) to "-79 dBm" as displayed on RF Level -dBm Display (3).
11.	Decrease RF LEVEL Control (6) in 1 dB steps, pausing 1 second between steps until UUT breaks lock-on condition.
12.	Increase RF LEVEL Control (6) by 1 dB. RF LEVEL -dBm Display (3) now displays track sensitivity. Note and record this level for later reference.

13. Set RF LEVEL Control (6) to +30 dB above lock-on sensitivity as established in Step 12, and verify UUT does not lock-on for more than one out of five search cycles. Should UUT lock-on, it should not track for more than 5 seconds.

NOTE

- To verify UUT is tracking and not in memory, the PRF must be equal to or less than 30 pp/s for 5 seconds plus memory time.

14. Place ΔF Thumbwheels (48) to "-ΔF" Position.

15. Adjust ΔF Thumbwheels (48) to obtain a displayed frequency of -0.94 MHz below the assigned channel frequency displayed on DISPLAY SELECT Readout (43).

16. Verify UUT does not lock-on for more than one out of five search cycles. Should UUT lock-on, it should not track for more than 5 seconds.

NOTE

- To verify UUT is tracking and not in memory, the PRF must be equal to or less than 30 pp/s for 5 seconds plus memory time.

17. Place ΔF Thumbwheels (48) to "OFF" Position.

4-3-8

TEST PROCEDURE: MEASURING ACCURACY AND TRACKING

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: NONE

TEST SET-UP DIAGRAM: FIGURE 2-2, PAGE 2-6

STEP	PROCEDURE
1.	Set ATC-1400 controls for general DME operation as shown in Figure 4-6, Page 4-26 and Figure 4-7, Page 4-27.
2.	Apply power to ATC-1400, allow a 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Verify internal frequency counter value on DISPLAY SELECT Readout (43) is 978.000 MHz (.02 MHz). Increment or decrement F Thumbwheels (48) in a positive or negative direction if necessary, to obtain correct frequency.
5.	Momentarily depress CLEAR RNG Push-button Switch (13) to clear test set of any previously loaded range, velocity and acceleration information.
6.	Place DISPLAY SELECT Control (40) to "DME DIST NMi" Position.
7.	Place RANGE/VEL/ACCEL Thumbwheels (52) to "100.00 nmi" Position.
8.	Place DME (UUT) to stand-by, allow 2 minute warm-up period, then place to norm Position, pause until UUT locks-on and verify a reading of 0.00 nmi (0.5 nmi).
9.	Place DISPLAY SELECT Control (40) to "RANGE NMi" Position.
10.	Momentarily depress LOAD VEL Push-button Switch (4) and verify DISPLAY SELECT Readout (43) reflects same reading as UUT distance indicator (0.5 nmi) or 3%, whichever is greater.
11.	Momentarily depress LOAD RNG Push-button Switch (2), pause until UUT locks-on, then verify UUT distance indicator reads 100.00 nmi (3 nmi). After a 30 second delay verify UUT distance displayed is 100 nmi (0.13 nmi).
12.	Place RANGE/VEL/ACCEL Thumbwheels (52) to "0600 KTS" Position.

13. Place IN/OUT Switch (14) to "IN" Position.

14. Momentarily depress LOAD VEL Push-button Switch (4) to verify UUT tracks inbound.

15. Place IN/OUT Switch (14) to "OUT" Position to verify UUT does not loose lock-on and tracks outbound.

16. Momentarily depress LOAD RNG Push-button Switch (2), pause until UUT locks-on, then momentarily depress LOAD VEL Push-button Switch to verify UUT tracks inbound.

17. Place DME REPLY EFFICIENCY Switch (39) to "0%" Position and verify DISPLAY SELECT Readout (43) reflects same reading as UUT indicator (±0.2 nmi) or 3%, whichever is greater, for duration of memory.

18. Place DME REPLY EFFICIENCY Switch (39) to "100%" Position, PRF/SQTR ON/OFF Switch (32) to "OFF" Position and verify UUT obtains lock-on and tracks.

19. Place DME REPLY EFFICIENCY Switch (39) to "0%" Position, pause for duration of memory time and verify flag on UUT indicator comes into view.

20. Place PRF/SQTR ON/OFF Switch (32) to "ON" Position and DME REPLY EFFICIENCY Control (39) to "70%" Position.

4-3-9

TEST PROCEDURE: MEASURING ACQUISITION TIME

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: Stopwatch

TEST SET-UP DIAGRAM: FIGURE 2-2, PAGE 2-6

STEP	PROCEDURE
1.	Set ATC-1400 controls for general DME operation as shown in Figure 4-6, Page 4-26 and Figure 4-7, Page 4-27.
2.	Apply power to ATC-1400, allow a 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Verify internal frequency counter value on DISPLAY SELECT Readout (43) is 978.000 MHz (.02 MHz). Increment or decrement F Thumbwheels (48) in a positive or negative direction if necessary, to obtain correct frequency.
5.	Momentarily depress CLEAR RNG Push-button Switch (13) to clear test set of any previously loaded range, velocity and acceleration information.
6.	Place DME (UUT) to stand-by, allow a 2 minute warm-up period.
7.	Place RANGE/VEL/ACCEL Thumbwheels (52) to "100.00 nmi" Position.
8.	Momentarily depress LOAD RNG Push-button Switch (2) to load previously selected range of 100 nmi into test set.
9.	Simultaneously place UUT to norm Position and start a stopwatch to measure the time required for UUT to reach lock-on, and UUT indicator to display 100 nmi (0.23 nmi). If acquisition time is more than 1 second, repeat this test several times and verify the UUT can demonstrate greater than 50% probability to lock-on in 1 second and greater than 90% probability to lock-on in 1.5 seconds.
10.	Place DME (UUT) to stand-by.

11. Place DISPLAY Select Control (40) to "RANGE NMi" Position.

12. Set RANGE/VEL/ACCEL Thumbwheels (52) to "1000 KTS" Position, IN/OUT Switch (14) to "IN" bound position and momentarily depress LOAD VEL Push-button Switch (4). Pause 10 seconds prior to proceeding to next step.

13. Simultaneously place UUT to norm Position and start a stop-watch to measure the time required for UUT to reach lock-on; UUT indicator and DISPLAY SELECT Readout (43) should both display 100 nmi (±0.23 nmi). If acquisition time is more than 1 second, repeat this test several times and verify the UUT can demonstrate greater than 50% probability to lock-on in 1 second and greater than 90% probability to lock-on in 1.5 seconds.

4-3-10

TEST PROCEDURE: MEASURING ECHO AND CO-CHANNEL PERFORMANCE

TEST OBJECTIVE: N/A

SPECIAL ACCESSORY EQUIPMENT REQ'D: Stopwatch

TEST SET-UP DIAGRAM: FIGURE 2-2, PAGE 2-6

STEP	PROCEDURE
1.	Set ATC-1400 controls for general DME operation as shown in Figure 4-6, Page 4-26 and Figure 4-7, Page 4-27.
2.	Apply power to ATC-1400, allow a 5 minute warm-up period.
3.	Perform ATC-1400 self test procedure outlined in para. 4-1-4, pg. 4-2.
4.	Verify internal frequency counter value on DISPLAY SELECT Readout (43) is 978.000 MHz (.02 MHz). Increment or decrement F Thumbwheels (48) in a positive or negative direction if necessary, to obtain correct frequency.
5.	Momentarily depress CLEAR RNG Push-button Switch (13) to clear test set of any previously loaded range, velocity and acceleration information.
6.	Place DME (UUT) to stand-by, allow a 2 minute warm-up period, then place UUT to norm Position.
7.	Momentarily depress LOAD RNG Push-button Switch (2) to load previously selected range of 40 nmi into test set.
8.	Using a stopwatch, record elapsed time from the instant DME REPLY EFFECIENCY Control (39) is placed in the "0%" Position and DME-PRF XPDR -% REPLY Display (46) reflects an increase of the UUT PRF. Verify elapsed time to be 8 seconds (4 seconds).
9.	Place SLS/ECHO ON/OFF Switch (18) to "ON" Position.
10.	Place DISPLAY SELECT Control (40) to "DME DIST NMi" Position.
11.	Verify DISPLAY SELECT Readout (43) displays 40 nmi.
12.	Place SLS/ECHO Thumbwheels (50) to "-0 dB" Position.

13. Pause for duration of elapse time obtained in Step 9 prior to performing next step.

14. Verify UUT indicator displays 30 nmi nominal.

15. Place SLS/ECHO Thumbwheels (50) to "-5 dB" Position.

16. Switch UUT to stand-by, then back to norm Position and verify UUT locks-on and displays approximately 40 nmi.

4-4 REMOTE CONTROL (GPIB) OPERATING PROCEDURES

Remote communication with the ATC-1400 is provided by use of the General Purpose Interface Bus (GPIB) which conforms to the latest IEEE standard 488-1978. The unit will perform to the following IEEE-488 subsets: SH1, AH1, T8, TEØ, L4, LEØ, SR1, RL1, PPØ, DC1, DT1, and CØ. These subsets mean the ATC-1400 is a talker, listener, primary address only, and has remote and local capability, device clear capability, device trigger capability, serial poll capability, and no parallel poll capability or controller capability.

All communication with the ATC-1400 over the GPIB is implemented with ASCII encoded character strings. Invalid or improperly formulated characters are discarded and an error status flag will be set. All ATC-1400 commands can be transmitted as packed ASCII character strings as defined in Paragraph 4-5-1 except ASCII character "!". This command is decoded immediately upon receipt and causes the ATC-1400 to return to local control via the front panel. Other commands which are not included in the instruction set but which will be operated on immediately are the IEEE-488 bus messages as follows:

MNEMONIC Message	ASCII Code (HEX)	IEEE-488 Instruction
MLA	XX (20 to 3E)	My Listen Address
MTA	XX (40 to 5E)	My Talk Address
GTL	Ø1	Go To Local
GET	Ø8	Group Execute Trigger
LLO	11	Local Lockout
DCL	14	Device Clear
SPE	18	Serial Poll Enable
SPD	19	Serial Poll Disable

4-4-1 GPIB TRANSACTIONS

Several examples of GPIB transactions showing the ASCII string to be transmitted followed by the necessary BUS operations to complete the transactions are shown below. These examples were generated and executed using a GPIB controller that uses an ANSI Standard Basic Interpreter with enhancements allowing direct communication over the GPIB using special GPIB interface hardware.

1. Example No. 1 - Command ATC-1400 to set RF Output Frequency to 1Ø8Ø MHz.

   a. ASCII String: "F1Ø8Ø"

   b. BUS Transaction: MLA, MTA, DAB"F", DAB"1", DAB"Ø", DAB"8", DAB"Ø", DAB CR, DAB LF, UNT, UNL.

2. Example No. 2: Command ATC-1400 to read back RF output frequency of 1080 MHz.

   a. ASCII String: -"F?", followed by a controller input command to input data.

   b. Return String: "#1080.00"

   c. BUS Transaction: MLA, MTA, DAB "F", DAV "?", DAB CR, DAB LF, UNT, UNL, MLA, MTA, DAB " ", DAB "1", DAB "0", DAB "8", DAB "0", DAB ".", DAB "0", DAB "0", DAB CR, DAB LF, UNT, UNL.

      # Denotes Blank Space

3. Example No. 3: Command ATC-1400 to return to local mode (Front Panel Operation).

   a. ASCII String: "!"

   b. BUS Transactions: MLA, MTA, DAB"!", DAB CR, DAB LF, UNT, UNL, or just issuing the GTB BUS message will have same effect.

4-4-2 STATUS AND SERVICE REQUEST TRANSACTION

The ATC-1400 has the ability to provide status information (SPE) and issue request for service (SRQ) depending on conditions set by the user with the ATC-1400 "SRM=XXXXXX" command. After the ATC-1400 is placed in remote operation mode it may be interrogated for the one byte status information. If the user also sets any of the SRQ mask bits to a "1" and when an error condition matches the mask bit a request for service (SRQ) will be issued by the ATC-1400. Status bits are defined below:

STATUS BIT NO.	CONDITION	DEFINITION
7	0	XPDR Function
7	1	DME Function
6	1	RSV (Request for Service)
5	1	UUT Pulse Position Error
4	1	UUT Frequency Invalid/Out of Lock
3	1	UUT Inactive (Low Power)
2	1	Invalid Command/Syntax Error
1	1	Auxiliary Error (No Connection/Invalid Command)
0	1	DME/XPDR Function Select Error

EXAMPLE: Status Transaction

Request is made for status from ATC-1400 with an address of 8:

GPSTAT(8)

Returned information is:

Bit No.:	7	6	5	4	3	2	1	Ø
Condition:	"1	Ø	Ø	1	1	Ø	Ø	1"

indicating ATC-1400 is in DME Function of operation, and UUT frequency is out of lock, lost its power and last command sent was a XPDR command creating an operation function error indication.

When the user wants to know if there is a pulse position error or operation function select error, command "SRM=1ØØØØ1" should be issued to trigger a service request whenever either of the two masked bits are active. The data string for "SRM=" is right-hand justified so not all six characters need to be output depending on the desired mask. If only an operation function error detect SRQ is desired, output the string "SRM=1". All previous mask bits are cleared every time the mask command is given.

EXAMPLE: Service Request Transaction

If a service request is triggered by issuing an "SRM=1" command prior to the XPDR command before status was requested (see Example: Status Transaction), then the returned status byte would have bit 6 set in addition to the other bits as shown below:

Bit No:	7	6	5	4	3	2	1	Ø
Condition:	"1	1	Ø	1	1	Ø	Ø	1"

Most controllers will respond to Bit No. 6 being set (1) as a request for service from the addressed device during a serial poll sequence.

NOTE

- The ATC-1400 powers up in local mode and will remain in this mode until it is addressed to talk or listen (MTA or MLA), or until it receives a local lockout or remote (LLO or REM) BUS message.

4-5 COMMAND AND DATA STRUCTURE

All communication with the ATC-1400 is done with uppercase ASCII character strings, which are designed to replace the front panel controls. There is a one-for-one correspondence between the ASCII commands and ATC-1400 front panel switches and displays with the exception of the MAN/AUTO/MAN STEP Switch (22), "XPDR" "VOR" "DME" and TACAN channeling function of the FREQ/FUNCTION SELECT Thumbwheels (45), INTERF PULSE WIDTH Control (31), CALØ Control (23), and FREQ STEP RATE Control (21). The front panel switches can be used to

program the initial condition or local state of the ATC-1400. The device clear message (GPIB DCL) will also reset the ATC-1400 to the current front panel conditions.

4-5-1 ASCII OUTPUT COMMANDS TO ATC-1400

All ASCII commands sent to the ATC-1400 with the exception of "!" are placed on an input stack to be processed at the completion of the transmission. The command string length may be up to sixty-four characters with spaces being optional, as they are ignored internally.

The commands may be packed together in random order within one long ($\leq$64 character) string, and without any separation delimiters.

4-5-2 ASCII OUTPUT COMMAND FORMAT EXAMPLE

Commands F1Ø3Ø, R39.5Ø, IDØ, D? can be transmitted as shown below:

"F1Ø3ØR39.5ØIDØD?"

The variable formats and ranges are explained in detail in Para. 4-7 thru 4-9-34. In general, variables greater than the allowable limit are set to the maximum limit and variables less than the allowable limit are set to the minimum limit. Invalid commands and data are ignored, but an error status flag will be set.

4-5-3 ASCII COMMANDS TO INPUT DATA FROM THE ATC-1400

Command instructions which pass data from the ATC-1400 to the GPIB end with a "?". These commands are placed on an internal stack in the ATC-1400 until either a group execute trigger BUS message (GET) is received or the ATC-1400 is addressed to talk. All measurements are made at the time the trigger is received or first time the unit is addressed to talk after the measurement command string is received. Resulting data from all measurements are then stored and passed to the BUS, one measurement at a time, in the order requested. When all data has been passed to the BUS, the ATC-1400 will output an ASCII "?" command to indicate there are no more pending results. All measurement input commands will be in the form of an ASCII decimal character string, preceded by an ASCII space character " ", and terminated by a carriage return and line feed.

Once the unit has made the measurements, no new measurements should be requested until all previous results have been passed to the BUS, as this action will destroy the data remaining to be transmitted.

4-5-4 ASCII INPUT COMMAND FORMAT EXAMPLE

Input example shown below is using a GPIB controller with an enhanced ANSI compatible basic interpreter. The ATC-1400 GPIB address is 8.

Measurement Request:

```
0010 Print #8, "R123.45V100A100R?V?"
0020 Input #8, A$
0030 IFA$="?" then STOP
0040 Print A$
0050 GOTO 20
RUN
```

Reply response:

```
123.45        100
(Range)    (Velocity)
```

4-6 ATC-1400 ALPHABETICAL QUICK REFERENCE ASCII COMMAND TABLE

The following is an alphabetical listing of the ASCII commands used in remote control operation of the ATC-1400, as seen from the computer terminal.

1. All commands are in ASCII Code.

2. Data listed under the Data List column reflects input/output data of ATC-1400. Data shown in parenthesis is input data, that not enclosed in parenthesis is output data, and a dash is used for commands having no input/output data.

3. Under Function column, the symbol represents which test set function the ASCII command is used. X is for Transponder function, D for DME function, and X/D the command is common to both DME and Transponder functions.

4. Following the instruction column of the command table is a column listing a page number where a more in-depth detailed description of the ASCII command can be found.

COMMAND	DATA LIST	FUNCTION	INSTRUCTION	PAGE NO.
!	---	X/D	Put ATC-1400 in Local Mode	4-66
A	XXX	D	Set acceleration (000 to 399 ft/sec^2)	4-78
AXn=	AAA--A	X/D	Aux unit instructions (n = 1 to 4)	4-54
	(AAA--A)	X/D	Aux unit response if required ("?" command was sent)	4-54
C?	(XXXXXX)	X	Get XPDR code/altitude	4-68
C.	---	X	Display XPDR code	4-67
CMØ	---	X/D	Select 1.45 µs CAL MARKS	4-54
CM1	---	X/D	Select 1.0 µs CAL MARKS	4-54a
D?	(XXXX.XX)	D	Get DME distance (-1 nmi to 399.00 nmi)	4-78
DC	'XXXXXX'	X/D	Display message (1 to 6 hex char)	4-54a
DCL.	---	X/D	Device Clear (return to Front Panel Set-Up)	4-55
DF=	X.XX	X/D	Set delta freq value (0.00 to 9.99 MHz)	4-55
DFØ	---	X/D	Cancel delta freq	4-56
DF+	---	X/D	Add delta freq to RF freq	4-56
DF-	---	X/D	Subtract delta freq	4-56
D.	---	D	Display DME distance	4-79
DI=	XXX.X	X	Enables double interr P_1 to P_1 spacing (21.0 µs to 399.0 µs)	4-69
DMEX	---	D	Set DME function to X channel	4-79
DMEY	---	D	Set DME function to Y channel	4-79
DV2=	X.X	D	Set DME P_2 pulse spacing	4-80
DV2Ø	---	D	Set DME P_2 to CAL	4-80
DV2+	---	D	Deviate DME P_2 positive	4-81
DV2-	---	D	Deviate DME P_2 negative (-19 to 9 dB)	4-81
ES=	XX	X/D	Set ECHO/SLS pulse amplitude	4-57
EQØ	---	D	Disable equalizer pulses	4-82
EQ1	---	D	Enable equalizer pulses	4-82
EØ	---	D	Disable ECHO pulses	4-83
E1	---	D	Enable ECHO pulses	4-82
E%	XXX	D	Set DME reply efficiency (0 to 100% in 1% steps)	4-83
F	XXXX	X/D	Set RF output frequency (962 to 1213 MHz)	4-57
F?	(XXXX.XX)	X/D	Get RF output frequency (962 to 1213 MHz + DF)	4-58
F.	---	X/D	Display RF output frequency	4-58
FP1	---	X/D	Sample and measure UUT's 1st pulse	4-58
FP2	---	X/D	Sample and measure UUT's 2nd pulse	4-59
IDØ	---	D	Disable IDENT tone	4-83
ID1	---	D	Enable IDENT tone	4-84
ID2	---	D	Enable CODE message	4-84
IP=	XXX.X	X	Enable and deviate INTRF pulse (-19.5 µS to 399.9 µS)	4-70
IPØ	---	X	Disable INTRF pulse and Double INTERR pulse	4-70
LOC.	---	X/D	Return to Local Mode	4-59
NMØ	---	D	Disable -1 NMi range	4-84
NM1	---	D	Enable -1 NMi range	4-85
P?	(XXXX)	X/D	Get PRF	4-59
P.	---	X/D	Display PRF	4-60
PS=	XXXX	X/D	Set DME PRF or squitter rate	4-60
PØ	---	X	Disable XPDR PRF	4-71
P1	---	X	Enable XPDR PRF	4-71
R	XXX.XX	D	Set DME range delay (Ø nmi to 399.00 nmi)	4-85
R?	(XXXX.XX)	D	Get DME range delay (-1 nmi to 399.00 nmi)	4-85
R.	---	D	Display DME range delay	4-86
RF	XXX	X/D	Set RF output level (Ø to -127 dBm)	4-61
RI	---	D	Set range delay inbound	4-86
RO	---	D	Set range delay outbound	4-86

COMMAND	DATA LIST	FUNCTION	INSTRUCTION	PAGE NO.
RTØ	---	X/D	Set RF output to normal	4-61
RT1	---	X/D	Set RF output to OFF	4-61
RT2	---	X/D	Set RF output to CW	4-62
SØ	---	X	Disable the XPDR SLS pulse	4-71
S1	---	X	Enable the XPDR SLS pulse	4-72
SIØ	---	D	Disable self-interrogation	4-87
SI1	---	D	Enable self-interrogation	4-87
SPØ	---	X/D	Disable suppressor pulse (front panel)	4-62
SP1	---	X/D	Enable suppressor pulse (front panel)	4-62
SQØ	---	D	Disable DME squitter	4-87
SQ1	---	D	Enable DME squitter	4-88
SRM=	XXXXXX	X/D	Set SRQ mask for desired SRQ signal	4-63
TCØ	---	D	Disable TACAN modulation	4-88
TC1	---	D	Enable TACAN modulation	4-88
TØ	---	X/D	Set SYNC to interrogation	4-63
TD	---	X/D	Set SYNC to reply	4-64
TT	---	X/D	Set SYNC to 15 Hz TACAN modulation	4-64
UF?	(XXX.XX)	X/D	Get UUT frequency (962 to 1213 MHZ + DF)	4-64
UP?	(XXXX)	D	Get UUT DME PRF	4-89
UW?	(XXXX)	X/D	Get UUT power in watts (10 to 1999 watts)	4-65
U%?	(XXXX)	X	Get UUT XPDR % reply (0 to 156%)	4-72
V	XXXØ	D	Set DME velocity (0 to 3990 KTS)	4-89
V?	(XXXØ)	D	Get DME velocity (0 to 3990 KTS)	4-90
V.	---	D	Display DME velocity	4-90
WN	---	X/D	Set narrow tolerance window	4-66
WW	---	X/D	Set wide tolerance window	4-66
X1	---	X	Set XPDR mode 1	4-73
X2	---	X	Set XPDR mode 2	4-73
XA	---	X	Set XPDR mode A	4-73
XB	---	X	Set XPDR mode B	4-73
XC	---	X	Set XPDR mode C	4-73
XD	---	X	Set XPDR mode D	4-73
XT	---	X	Set XPDR mode T	4-73
XA1	---	X	Set XPDR mode AC1	4-73
XA2	---	X	Set XPDR mode AC2	4-73
XP=	X.XX	X	Set XPDR pulse width (0.10 µs to 1.95 µs in Ø.Ø5 µs steps)	4-73
XPØ	---	X	Set XPDR pulse width to CAL	4-74
XP1	---	X	Set XPDR pulse width from 0.10 µs to 1.95 µs	4-74
XV=	X.XX	X	Set P_2/P_3 deviation (Ø.ØØ to 1.95 µs in Ø.Ø5 µs steps)	4-74
XV2Ø	---	X	Set P_2 pulse spacing to CAL	4-75
XV2+	---	X	Increase P_2 pulse spacing by value set in "XV=X.XX"	4-75
XV2-	---	X	Decrease P_2 pulse spacing by value set in "XV=X.XX"	4-76
XV3Ø	---	X	Set P_3 pulse spacing to CAL	4-76
XV3+	---	X	Increase P_3 pulse spacing by value set in "XV=X.XX"	4-77
XV3-	---	X	Decrease P_3 pulse spacing by value set in "XV=X.XX"	4-77

4-7 EXPLANATION OF CODES FOR COMMON COMMANDS

In the following paragraphs (4-7-1 thru 4-7-31) is a detailed description of the ASCII Commands used in the common (DME and transponder) function of operation for the ATC-1400, as seen from the computer terminal.

1. All commands are in ASCII Code.

2. Data listed under the Data List column reflects input/output data of the ATC-1400. Data shown enclosed in parenthesis is input data, that not enclosed in parenthesis is output data, and "None" indicates no input/output data flow.

4-7-0 ——— COMMAND: AXn ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - AXn
Data List (send) - AAA--A
(receive) - (AAA--A)

COMMAND DEFINITION: Transfers the entire data list to the auxiliary unit for processing. If a "?" command appears in the "send" data list, the ATC-1400 will wait for a "receive" data list to be transfered back.

DATA LIST DEFINITION: (Send) 1 to 60 ASCII Characters and (Receive) 1 to 64 ASCII Characters.

ERROR CONDITION:
Less than 1 character or greater than 60 characters to be transfered (data list will be truncated).
Greater than 64 characters in the "receive" data list (truncated) or invalid command.

RESPONSE:
A "?" will be inserted in the "receive" data list.

4-7-1 ——— COMMAND: CMØ ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - CMØ
Data List - none

COMMAND DEFINITION: Selects 1.45 µs calibration marks which are presented at CAL MARKS Connector (26) on front panel of ATC-1400, for UUT calibration and alignment.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:
N/A

RESPONSE:
N/A

4-7-2 COMMAND: CM1

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - CM1
Data List - none

COMMAND DEFINITION: Selects 1.Ø µs calibration marks which is presented at CAL MARKS Connector (26) on front panel of ATC-1400, for UUT calibration and alignment.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
N/A	N/A

4-7-3 COMMAND: DC'HHHHHH'

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - DC
Data List - 'HHHHHH'

COMMAND DEFINITION: Display six hexadecimal characters on DISPLAY SELECT Readout (43).

DATA LIST DEFINITION: Up to six hexadecimal ASCII Characters enclosed by ASCII apostrophies are displayed.

EXAMPLE: ASCII character string "DC'123ABC'" will instruct ATC-1400 to display "123ABC" on DISPLAY SELECT Readout (43).

ERROR CONDITION:	RESPONSE:
Invalid data in data list.	Character is set to Ø.

4-7-3a ——— COMMAND: DCL ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - DCL
Data List - none

COMMAND DEFINITION: Returns ATC-1400 to Front Panel Set-Up.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
N/A	N/A

4-7-4 ——— COMMAND: DF=X.XX ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - DF=
Data List - X.XX

COMMAND DEFINITION: Instructs ATC-1400 ΔF offset to be fixed at X.XX MHz. This command operates in conjunction with "DFØ", "DF+", and "DF-" commands.

DATA LIST DEFINITION: A maximum of four ASCII digits including the decimal point are output to the ATC-1400, with a range of Ø.ØØ MHz to 9.99 MHz.

EXAMPLE: ASCII character string "DF-1.ØØ" instructs ATC-1400 to offset the RF output frequency by 1.ØØ MHz.

ERROR CONDITION:	RESPONSE:
Data value >9.99 MHz.	Defaults to 9.99 MHz.

4-7-5 COMMAND: DFØ

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - DFØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to cancel ΔF offset previously set by "DF=X.XX" command.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: RESPONSE:
N/A N/A

4-7-6 COMMAND: DF+

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - DF+
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to add previously set ΔF offset value to R.F. output frequency.

DATA LIST DEFINITION: No input/output data.

EXAMPLE: ASCII character string "DF+" will add the value set by the "DF=X.XX" command to present frequency.

ERROR CONDITION: RESPONSE:
N/A N/A

4-7-7 COMMAND: DF-

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - DF-
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to subtract previously set ΔF offset value to R.F. output frequency.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: RESPONSE:
N/A N/A

4-7-8 ——— COMMAND: ES=±XX ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - ES=
Data List - ±XX

COMMAND DEFINITION: Instructs ATC-1400 to set amplitude of ECHO pulse (DME Function) when enabled by the "E1" command, or amplitude of SLS pulse (XPDR Function) when enabled by "S1" command, to the value given in data list.

DATA LIST DEFINITION: Outputs up to two (2) decimal ASCII digits plus either an optional "+" or "-" sign with values from 9 to -19 dB.

EXAMPLE: The following ASCII character strings are valid commands: "ES=5", "ES=+9", "ES=-1Ø", whereas "ES=" command defaults to "ES=Ø".

ERROR CONDITION:	RESPONSE:
Data list values over range.	Default to maximum value for the sign given.

4-7-9 ——— COMMAND: FXXXX ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - F
Data List - XXXX

COMMAND DEFINITION: Instructs ATC-1400 to set R.F. output frequency to XXXX MHz. Actual frequency can be offset from set value in Ø.Ø1 MHz steps by using ASCII Command "DF=".

DATA LIST DEFINITION: Outputs a maximum of four (4) decimal ASCII digits between 962 MHz and 1213 MHz.

EXAMPLE: ASCII character string "F1Ø3Ø" set RF output frequency to 1Ø3Ø.ØØ MHz providing no delta frequency was previously set.

ERROR CONDITION:	RESPONSE:
Frequency selection is out of specified range.	MSD is set to an "E".

4-7-10 COMMAND: F?

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - F?
Data List (XXXX.XX)

COMMAND DEFINITION: Instructs the ATC-1400 to read the R.F. output frequency and return it via the GPIB.

DATA LIST DEFINITION: The ASCII code generated in response to the "F?" command consists of seven (7) ASCII characters including the decimal point between the fourth and fifth digit.

ERROR CONDITION:	RESPONSE:
Frequency setting exceeds allowable frequency range.	"EXXX.XX" will be returned.

4-7-11 COMMAND: F.

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - F.
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to display R.F. output frequency on DISPLAY SELECT Readout (43) and transmit serial range data (DME Function) to rear panel INDICATOR Connector J7 (67).

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Frequency setting exceeds allowable range.	"EXXX.XX" displayed on DISPLAY SELECT Readout (43).

4-7-12 COMMAND: FP1

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - FP1
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to sample and measure frequency and power of the UUT transponder F_1 framing pulse and DME P_1 interrogation pulse.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
N/A	N/A

4-7-13 ——— COMMAND: FP2 ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - FP2
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to sample and measure frequency and power of the UUT transponder F_2 framing pulse and DME P_2 interrogation pulse.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: N/A

RESPONSE: N/A

4-7-13a ——— COMMAND: LOC ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - LOC
Data List - none

COMMAND DEFINITION: Returns ATC-1400 to Local (Manual) Operation.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: N/A

RESPONSE: N/A

4-7-14 ——— COMMAND: P? ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - P?
Data List - (XXXX)

COMMAND DEFINITION: Instructs ATC-1400 to read the internal PRF counter and transfer this value to the GPIB when addressed to talk.

DATA LIST DEFINITION: Data input from ATC-1400 in response to the "P?" command consists of four (4) characters.

ERROR CONDITION: Data value out of range.

RESPONSE: Value defaults to maximum.

NOTE

- ATC-1400 must be allowed to set-up time before commanding a measurement. The parameter being measured must remain stable for 2.Ø seconds prior to command execution.

4-7-15 ——— COMMAND: P. ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - P.
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 display internal PRF of test set on DISPLAY FUNCTION Readout (43), and transmit serial range data (DME Function) to rear panel INDICATOR Connector J7 (67).

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Data value out of range.	Value defaults to maximum.

4-7-16 ——— COMMAND: PS=XXXX ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - PS=
Data List - XXXX

COMMAND DEFINITION: Instructs ATC-1400 to set transponder PRF or DME squitter rate from ØØØØ Hz to 7999 Hz.

DATA LIST DEFINITION: Outputs a maximum of four (4) decimal ASCII characters from ØØØØ Hz to 7999 Hz.

EXAMPLE: ASCII character string "PS=1ØØ" sets PRF to 1ØØ Hz in Transponder Function or squitter to 1ØØ Hz in DME Function, in conjunction with "SQØ" and "SQ1" commands.

ERROR CONDITION:	RESPONSE:
Data value out of range.	Value defaults to maximum.

4-7-17 ——— COMMAND: RFXXX ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - RF
Data List - XXX

COMMAND DEFINITION: Instructs ATC-1400 to set RF output level from Ø dBm to -127 dBm in 1 dBm steps.

DATA LIST DEFINITION: Outputs a maximum of three (3) decimal ASCII Digits between Ø and 127.

EXAMPLE: ASCII character string "RF6Ø" sets RF output level to -6Ø dBm.

ERROR CONDITION: Data value out of range.

RESPONSE: Value defaults to maximum.

4-7-18 ——— COMMAND: RTØ ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - RTØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set R.F. output to NORM mode, permitting DME and transponder modulation.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: N/A

RESPONSE: N/A

4-7-19 ——— COMMAND: RT1 ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - RT1
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to turn R.F. output to OFF, inhibiting all pulses generated by the test set.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: N/A

RESPONSE: N/A

4-7-20 COMMAND: RT2

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - RT2
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set R.F. output for CW operation which provides a continuous wave output for test and calibration of the test set.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: N/A

RESPONSE: N/A

4-7-21 COMMAND: SPØ

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - SPØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to disable suppressor pulse at SUPPRESSOR OUTPUT Connector (16).

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: N/A

RESPONSE: N/A

4-7-22 COMMAND: SP1

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - SP1
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to enable suppressor pulses at SUPPRESSOR OUTPUT Connector (16).

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: N/A

RESPONSE: N/A

4-7-23 ——— COMMAND: SRM=XXXXXX ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - SRM=
Data List - XXXXXX

COMMAND DEFINITION: Instructs ATC-1400 to set the service request mask to enable an SRQ signal to be sent to the GPIB controller when an error condition within the ATC-1400 causes one or more of the six error flags to be set. The mask will ensure, regardless of how many different errors occur, only those that correspond to bits set in the mask will actually cause an SRQ signal to be transmitted. When the controller responds to the SRQ signal, it may then issue a serial poll command or a read status command to obtain the ATC-1400 status byte.

DATA LIST DEFINITION: Outputs up to six (6) decimal ASCII characters ("1" enable, "Ø" disable) to indicate which error condition you wish to have serviced. Mask bits are defined below:

Status Bit No.	Condition	Definition
5	1	UUT Pulse Position Error
4	1	UUT Frequency Invalid/Out of Lock
3	1	UUT Inactive (Low Power)
2	1	UUT Command/Syntax Error
1	1	Auxiliary Error (No Connection/Invalid Command)
0	1	DME/XPDR Function Select Error

EXAMPLE: Output of ASCII character string "SRM=1001" will cause the ATC-1400A to request servicing from the GPIB controller if UUT is disconnected, or if an invalid function command is sent (i.e., trying to read or display range data with ATC-1400 in XPDR function).

ERROR CONDITION:
N/A

RESPONSE:
N/A

4-7-24 ——— COMMAND: TØ ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - TØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set SYNC output to coincide with DME or XPDR interrogation.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:
N/A

RESPONSE:
N/A

4-7-25 COMMAND: TD

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - TD
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set SYNC output to coincide with DME or XPDR reply.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
N/A	N/A

4-7-26 COMMAND: TT

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - TT
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set SYNC output to coincide with the 15 Hz TACAN modulation.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
TACAN not enabled.	No sync output at SYNC Connector (29).

4-7-27 COMMAND: UF?

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - UF?
Data List - (XXXX.XX)

COMMAND DEFINITION: Instructs ATC-1400 to measure UUT frequency and transfer data to the GPIB.

DATA LIST DEFINITION: Inputs up to seven (7) decimal ASCII Digits including the decimal point between the fourth and fifth digit.

ERROR CONDITION:	RESPONSE:
UUT frequency invalid/out of lock.	GPIB status bit 3 set.

NOTE

- UUT frequency measurements must be allowed a set-up time before commanding a measurement. The UUT frequency must remain stable during set-up. The ASCII character string is "ØØØØ.ØØ" when the frequency discriminator is unlocked. The maximum set-up time required is no more than 4Ø XPDR replies or 4Ø DME interrogations.

4-7-28 ——— COMMAND: UW? ———

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - UW?
Data List - (XXXX)

COMMAND DEFINITION: Instructs ATC-1400 to measure UUT output power and transfer DATA to the GPIB when addressed to talk.

DATA LIST DEFINITION: Inputs up to four (4) decimal ASCII Digits in response to the "UW?" command representing power in watts from 1Ø to 1999 watts.

ERROR CONDITION:	RESPONSE:
Power exceeds 1999 watts.	"EEEE" is displayed on XMTR PWR WATTS Display (1), also returned on GPIB BUS.

NOTE

- If power does not exceed 1Ø watts, the ASCII character string will be "ØØØØ". A set-up time must be allowed before commanding a measurement. The UUT power must remain stable during set-up. Maximum set-up time required is no more than 4Ø XPDR replys or 4Ø DME interrogations.

4-7-29 COMMAND: WN

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - WN
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to select a narrow tolerance for the window used to detect transponder or DME pulses.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: RESPONSE:
N/A N/A

4-7-30 COMMAND: WW

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - WW
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to select a wide tolerance for the window used to detect transponder or DME pulses.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION: RESPONSE:
N/A N/A

4-7-31 COMMAND: !

FUNCTION: XPDR/DME

INSTRUCTION FORMAT: ASCII Command - !
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to go to local or front panel mode of operation immediately upon entry. If ASCII character "!" is inserted within a longer command string, all other characters will be ignored.

DATA LIST DEFINITION: No input/output data.

EXAMPLE: ASCII character string "!" or "A1ØØDF=1.11!" will command ATC-1400 to return to local mode of operation, and ignore acceleration and delta frequency commands.

ERROR CONDITION: RESPONSE:
N/A N/A

4-8 EXPLANATION OF CODES FOR TRANSPONDER COMMANDS

In the following paragraphs (4-8-1 thru 4-8-21) is a detailed description of the ASCII Commands used in the Transponder Function of operation of ATC-1400, as seen from the computer terminal.

1. All commands are in ASCII Code.

2. Data listed under the Data List column reflects input/output data of the ATC-1400. Data shown enclosed in parenthesis is input data, that not enclosed in parenthesis is output data, and "None" indicates no input/output data flow.

4-8-1 ——————— COMMAND: C. ———————

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - C.
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to display the XPDR CODE function of DISPLAY SELECT Switch (40) on DISPLAY SELECT Readout (43).

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	"OFF" is displayed on DISPLAY SELECT READOUT (43), and GPIB status bit Ø (GPSTAT Ø) is set.

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - C?
Data List - (XXXXXX)

COMMAND DEFINITION: Instructs ATC-1400 to output XPDR CODE or altitude information thru the GPIB when addressed to talk.

DATA LIST DEFINITION: Data input from the ATC-1400 in response to the "C?" command consists of the following:

VALID DATA	XPDR MODE	DEFINITION
XX0000	A Mode	0000 = OCTAL Format
XX0000	C Mode	0000 = OCTAL Format
XX0000	AC1 Mode	0000 = OCTAL Format
XXdddd	AC2 Mode	dddd = ft ÷ 1ØØØ

INVALID DATA
CCCCCC - No incoming interrogations.

ERROR CONDITION:
Test set in DME function.

RESPONSE:
A question mark is returned, and GPIB status bit Ø (GPSTAT Ø) is set.

NOTE

- The ASCII character string generated in response to "C?" command consists of six (6) to eight (8) characters depending on transponder mode.

A. In C and AC2 Modes, ASCII character string will consist of either seven (7) or eight (8) characters as follows:

1	2(1)	3(2)	4(3)	5(4)	6(5)	7(6)	8(7)
-	A	A	N	N	N	N	N

Character No.	Function
1	Minus sign (2D Hex) character is present only when BCD altitude is below sea level, otherwise there will be seven (7) characters as denoted in parenthesis ( ).
2, 3, (1,2)	These characters can be one (1) of four (4) combinations of ASCII characters. FØ - Indicates Transponder F_2 Pulse is missing. ID - Indicates SPI (IDENT) Pulse is present.

FD - Indicates SPI (IDENT) Pulse is present and F_2 Pulse is missing.

ØØ - Indicates F_2 Pulse is present and SPI (IDENT) Pulse is missing.

4-8 (3-7) These characters are decimal numbers representing ft ÷1ØØØ (-Ø1.Ø to 126.5 thousand feet).

If improper altitude is received, the character string will be "EEE.E".

B. In all modes except mode C and AC2, the character string will consist of six (6) characters as follows:

1	2	3	4	5	6
A	A	N	N	N	N

Character No.	Function
1, 2	Same as 2, 3, (1,2) for C and AC2 modes.
3, 6	These characters represent the four digit octal code received from UUT.

4-8-3 COMMAND: DI=XXX.X

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - DI=
Data List - XXX.X

COMMAND DEFINITION: Instructs ATC-1400 to initiate double interrogations with a P_1 to P_1 spacing of 21.Ø µs to 399.Ø µs. Double Interrogations can be terminated by ASCII Command "DI=Ø" or by initiating the interference pulse with ASCII Command "IP=". (i.e. ASCII character string "DI=1ØØ" is double interrogations at 1ØØ.Ø µs, "DI=50.5" is double interrogation at 50.5 µs, and "DI=Ø" disables double interrogations).

DATA LIST DEFINITION: Outputs a maximum of five (5) decimal ASCII digits including a decimal point prior to the last digit if greater resolution than one (1) microsecond is desired.

EXAMPLE: ASCII character string "DI=1ØØ", "DI=5ØØ" and "DI=Ø" will initiate double interrogations at 1ØØ.Ø µs, 5Ø.5 µs, and disable double interrogations.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-4 ——— COMMAND: IP=XXX.X ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - IP=
Data List - ±XXX.X

COMMAND DEFINITION: Instructs ATC-1400 to enable the interference pulse and deviate it from P_1 pulse -19.5 µs to 399.9 µs. Interference pulses can be terminated by ASCII Command "IPØ" or by initiating the double interrogation command "DI=" (i.e. ASCII Character string "IP= -5.6" turns on the interference pulse 5.6 µs before P_1 pulse, and "IPØ" turns it off).

DATA LIST DEFINITION: Outputs a maximum of five (5) decimal ASCII digits including a decimal point between the least significant digit and the preceding digit. A negative sign is inserted if the value to be output is less than zero, whereas the positive sign is option.

EXAMPLE: ASCII character string "IP=-5.6" turns on interference pulse 5.6 µs before P_1 pulse. "IP=Ø" turns off interference pulse.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-5 ——— COMMAND: IPØ ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - IPØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to turn off INTERFERENCE pulse.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-6 ——— COMMAND: PØ ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - PØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to turn off transponder PRF.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-7 ——— COMMAND: P1 ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - P1
Data List - none

COMMAND DEFINITION: Instructions ATC-1400 to enable transponder PRF.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-8 ——— COMMAND: SØ ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - SØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to turn off transponder SLS (P_2) pulse.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-9 ——— COMMAND: S1 ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - S1
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to enable transponder SLS (P_2) pulse.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

NOTE

- ATC-1400 SLS level is set by ASCII Command "ES=".

4-8-10 ——— COMMAND: U%? ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - U%?
Data List - (XXX)

COMMAND DEFINITION: Instructs ATC-1400 to measure UUT percent reply and transfer this data to the GPIB when addressed to talk.

DATA LIST DEFINITION: The ASCII character string generated in response to "U%?" command will consist of up to three decimal digits representing percent reply from Ø to 156%.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	Question mark is returned, also GPSTAT bit Ø set.

NOTE

- ATC-1400 must be allowed a set-up time before measuring percent reply. Parameters being measured must remain stable for 2ØØ interrogations prior to execution of the percent reply command.

4-8-11 COMMAND: Xm

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - Xm
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set one of the following XPDR Modes as listed below:

ASCII COMMAND	XPDR MODE
X1	1
X2	2
XT	T
XA	A
XB	B
XC	C
XD	D
XA1	AC1
XA2	AC2

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
N/A	N/A

4-8-12 COMMAND: XP=X.XX

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - XP=
Data List - X.XX

COMMAND DEFINITION: Instructs ATC-1400 to set transponder pulse width from Ø.1Ø µs to 1.95 µs.

DATA LIST DEFINITION: Outputs a maximum of four (4) decimal ASCII Digits including a decimal point between the first and second digit.

ERROR CONDITION:	RESPONSE:
Variable is not a multiple of Ø.Ø5 µs.	Command is ignored.
Test set in DME function.	GPSTAT bit Ø set.

NOTE

- The above command is active only when the ATC-1400 is set to variable pulse width mode by ASCII Command "XP1".

4-8-13 ——— COMMAND: XPØ ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - XPØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set transponder pulse width to calibration value of Ø.8 µs.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-14 ——— COMMAND: XP1 ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - XP1
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set transponder pulse width to a variable value set by ASCII command "XP=X.XX". (Ref. Para. 4-8-11)

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-15 ——— COMMAND: XV=X.XX ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - XV=
Data List - X.XX

COMMAND DEFINITION: Instructs ATC-1400 to set transponder P_2/P_3 deviation from Ø.ØØ µs to 1.95 µs in Ø.Ø5 µs steps.

DATA LIST DEFINITION: Outputs a maximum of four (4) decimal ASCII Digits including a decimal point between the first and second digit.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

NOTE

- Deviation value can be applied to either the P_2 or P_3 pulse as a positive or negative value by following the ASCII Command "XV=" with "XV2+", "XV2-", "XV3+" or "XV3-".

4-8-16 COMMAND: XV2Ø

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - XV2Ø
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set transponder P_2 pulse spacing to it's calibrated position of 2.Ø µs.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

NOTE

- ASCII Command "XV2Ø" disables the variable value set by ASCII Command "XV=X.XX".

4-8-17 COMMAND: XV2+

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - XV2+
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to increase transponder P_2 pulse spacing by the value set by ASCII Command "XV=X.XX".

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-18 COMMAND: XV2-

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - XV2-
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to decrease transponder P_2 pulse spacing by the value set by ASCII Command "XV=X.XX".

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-19 COMMAND: XV3Ø

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - XV3Ø
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set transponder P_3 pulse spacing to its calibrated value as listed below for mode of operation:

INTERR PULSE	MODE OF OPERATION	P_3 PULSE SPACING
P_3	MODE 1	3.Ø µs
P_3	MODE 2	5.Ø µs
P_3	MODE T	6.5 µs
P_3	MODE A	8.Ø µs
P_3	MODE B	17.Ø µs
P_3	MODE C	21.Ø µs
P_3	MODE D	25.Ø µs

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-20 ——— COMMAND: XV3+ ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - XV3+
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to increase transponder P_3 pulse spacing by the value set by ASCII Command "XV=X.XX".

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-8-21 ——— COMMAND: XV3- ———

FUNCTION: XPDR

INSTRUCTION FORMAT: ASCII Command - XV3-
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to decrease transponder P_3 pulse spacing by the value set by ASCII Command "XV=X.XX".

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in DME function.	GPSTAT bit Ø set.

4-9 EXPLANATION OF CODES FOR DME COMMANDS

In the following paragraphs (4-9-1 thru 4-9-34) is a detailed description of the ASCII Commands used in the DME Function of operation of ATC-1400, as seen from the computer terminal.

a. All commands are in ASCII Code.

b. Data listed under the data list column reflects input/output data of the ATC-1400. Data shown enclosed in parenthesis is input data, that not enclosed in parenthesis is output data, and "none" indicates no input/output data flow.

4-9-1 COMMAND: AXXX

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - A
Data List - XXX

COMMAND DEFINITION: Instructs ATC-1400 to set acceleration value from ØØØ to 399 ft/sec^2 in 1 ft/sec^2 increments. (i.e. ASCII character string "A123" or "A 123" sets DME acceleration to 123 ft/sec^2.

DATA LIST DEFINITION: Outputs a maximum of three (3) ASCII decimal digits from ØØØ to 399.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

NOTE

- ASCII Command "AXXX" also loads last programmed input value of velocity ("VXXXØ") rather than latest value obtained thru acceleration.

4-9-2 COMMAND: D?

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - D?
Data List - (XXXX.XX)

COMMAND DEFINITION: Instructs ATC-1400 to output DME serial BCD distance data to the GPIB when addressed to talk.

DATA LIST DEFINITION: ASCII character string returned in response to ASCII Command "D?" consists of seven (7) characters including the decimal point. If no serial data is received when the receiver is activated by the "D?" command, the string will be "DDDD.DD". Under normal operating conditions all six characters will represent decimal numbers.

ERROR CONDITION:	RESPONSE:
Inproper non-zero pad detected.	"AXXX.XX"
Word status indicates no data.	"DXXX.XX"
Word status indicates function test.	"FXXX.XX"
Word status not defined.	"EXXX.XX"
Command "D." not issued previously.	"EEEE.EE"
Test set in XPDR function.	Question mark returned, and GPSTAT bit Ø set.

4-9-3 COMMAND: D.

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - D.
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to display DME serial BCD distance data on DISPLAY SELECT Readout (43). Serial data will be received from the UUT to rear panel INTERROGATOR Connector J8 (66) when this command is active, and the ATC-1400 will output serial data to the UUT when any of the other front panel display select control commands are active.

DATA LIST DEFINITION: No Input/Output Data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-4 COMMAND: DMEX

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - DMEX
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to operate in DME function, X channel. It enables all DME functions and disables all XPDR functions.

DATA LIST DEFINITION:

ERROR CONDITION:	RESPONSE:
N/A	N/A

4-9-5 COMMAND: DMEY

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - DMEY
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to operate in DME function, Y channel. It enables all DME functions and disables all XPDR functions.

ERROR CONDITIONS:	RESPONSE:
N/A	N/A

4-9-6 ——— COMMAND: DV2=X.X ———

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - DV2=
Data List - X.X

COMMAND DEFINITION: Instructs ATC-1400 to deviate P_2 pulse spacing from the calibrated position ±7.9 µs in X and Y Channel. The "DV2=" Command works in conjunction with ASCII Commands "DV2Ø", "DV2+", or "DV2-".

DATA LIST DEFINITION: Outputs a maximum of three (3) decimal ASCII Digits including a decimal point between the first and second digit.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-7 ——— COMMAND: DV2Ø ———

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - DV2Ø
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to cancel any deviation of the P_2 pulse and to return to the calibrated position.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-8 ——— COMMAND: DV2+ ———

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - DV2+
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to deviate the P_2 pulse spacing in a positive direction from the calibrated value by the amount previously set by ASCII "DV2=X.X" Command (i.e. "DV2=1.5" sets deviation of P_2 pulse to 1.5 µs. When "DV+" is received, pulse spacing is increased by 1.5 µs from the calibrated position).

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
"DV2=X.X Command was not executed prior to this command.	Invalid positive offset.
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-9 ——— COMMAND: DV2- ———

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - DV2-
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to deviate the P_2 pulse spacing in a negative direction from the calibrated value by the amount previously set by ASCII "DV2=X.X" command (i.e. "DV2=1.5" sets deviation of P_2 pulse to 1.5 µs. When "DV-" is received, pulse spacing is decreased by 1.5 µs from the calibrated position.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
"DV2=XX" Command was not executed prior to this command.	Invalid negative deviation.
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-10 COMMAND: EQØ

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - EQØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to disable EQUALIZER pulses.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-11 COMMAND: EQ1

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - EQ1
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to enable EQUALIZER pulses.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-12 COMMAND: E1

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - E1
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to enable ECHO pulses to an amplitude by the value set by ASCII command "ES=".

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-13 COMMAND: EØ

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - EØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to disable ECHO pulses.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-14 COMMAND: E%XXX

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - E%
Data List - XXX

COMMAND DEFINITION: Instructs ATC-1400 to set DME reply efficiency rate from 0 to 100% in 1% increments.

DATA LIST DEFINITION: Output a maximum of three (3) decimal ASCII Digits.

EXAMPLE: ASCII Character string "E%75" instructs ATC-1400 to set reply efficiency rate to 75%.

ERROR CONDITION:	RESPONSE:
Variable is 100%. Test set in XPDR function.	Command is ignored. GPSTAT bit Ø set.

4-9-15 COMMAND: IDØ

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - IDØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to turn off IDENT modulation.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-16 COMMAND: ID1

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - ID1
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to modulate R.F. Output with a fixed audio (IDENT) tone.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-17 COMMAND: ID2

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - ID2
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to modulate R.F. Output with an encoded message, (THE initials "IFR" in morse code).

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-18 COMMAND: NMØ

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - NMØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to disable -1 Nautical Mile Range calibration feature, which when enabled substracts 1.Ø nmi from range value.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-19 ——— COMMAND: NM1 ———

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - NM1
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set the -1 Nautical Mile Range feature which substracts -1.Ø nmi from range value.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-20 ——— COMMAND: RXXX.XX ———

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - R
Data List - XXX.XX

COMMAND DEFINITION: Instructs ATC-1400 to set range delay from ØØ.Ø nmi to 399.99 nmi (i.e. "R145.5Ø" sets range delay to 145.5Ø nmi).

DATA LIST DEFINITION: Outputs a maximum of six (6) decimal ASCII digits including a decimal point between the third and fourth digit.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-21 ——— COMMAND: R? ———

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - R?
Data List - (XXX.XX)

COMMAND DEFINITION: Instructs ATC-1400 to read internal range delay and transfer this data to the GPIB when addressed to talk.

DATA LIST DEFINITION: Data input from the ATC-1400 in response to ASCII Command "R?" consists of six (6) decimal ASCII characters including a decimal point between the third and fourth digit.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-22 COMMAND: R.

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - R.
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to continuously display current range delay on DISPLAY SELECT READOUT (43), and transmit serial range data to rear panel INDICATOR Connector J7 (67).

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-23 COMMAND: RI

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - RI
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set range delay to simulate an inbound aircraft.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-24 COMMAND: RO

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - RO
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to set range delay to simulate an outbound aircraft.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-25 COMMAND: SIØ

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - SIØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to turn off self-interrogation feature (normal mode of operation).

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-26 COMMAND: SI1

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - SI1
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to turn on self-interrogation feature.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-27 COMMAND: SQØ

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - SQØ
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to turn off DME Squitter.

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

4-9-33 COMMAND: V?

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - V?
Data List - (XXXØ)

COMMAND DEFINITION: Instructs ATC-1400 to read the internal velocity counters and transfer this data to the GPIB when addressed to talk.

DATA LIST DEFINITION: Outputs a maximum of four (4) decimal characters, the last of which will always be zero.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

NOTE

- ASCII Command "AXXX" will also load latest programmed value of velocity.

4-9-34 COMMAND: V.

FUNCTION: DME

INSTRUCTION FORMAT: ASCII Command - V.
Data List - none

COMMAND DEFINITION: Instructs ATC-1400 to continuously display current loaded value of velocity on DISPLAY SELECT Readout (43), and transmit serial range data to rear panel INDICATOR Connector J7 (67).

DATA LIST DEFINITION: No input/output data.

ERROR CONDITION:	RESPONSE:
Test set in XPDR function.	GPSTAT bit Ø set.

APPENDICES

APPENDIX A: SPECIFICATIONS ATC-1400

A-1 SIGNAL GENERATOR CHARACTERISTICS:

FREQUENCY:

Range:	952.01 MHz to 1222.99 MHz
Accuracy:	±15 kHz (Counter Display)
Display Resolution:	10 kHz
Channel Selection:	962 MHz to 1213 MHz in 1 MHz increments
ΔF:	±9.99 MHz in 10 kHz increments from selected frequency

R.F. OUTPUT:

Range:	0 dBm to -110 dBm in 1 dB increments
Absolute Accuracy:	±2.0 dB, 0 dBm to -90 dBm ±2.5 dB, -90 dBm to -110 dBm
Attenuator Accuracy:	±0.3 dB or 1%
ON/OFF Ratio:	80 dB minimum (XPDR Function)
Output Impedence:	50Ω, VSWR <1.2:1

SPECTRAL PURITY (CW):

Residual FM:	5 kHz peak-to-peak maximum in a 300 to 3 kHz bandwidth
Phase Noise:	>90 dBc/Hz measured at 150 kHz from carrier
Spurious:	>60 dBc measured from 350 MHz to 1800 MHz

SUPPRESSOR PULSE OUTPUT: (Into a 2 KΩ resistive load)

Pulse Width:	33 µs ±3 µs
Amplitude:	Adjustable from 3 V to 27 V
Timing:	Nominally 3.5 µs before P_1 of range reply

TRANSPONDER:

Single Interrogation:	0.8 μs prior to P_3
Interference:	Coincident with INTF pulse position (INTF pulse is removed)
Double Interrogation:	First interrogation is removed. The Double Interrogation spacing indicates time from leading edge of suppressor to P of the second interrogation.

A-2 DME MODE CHARACTERISTICS:

RANGE DELAY:

Range:	-1.00 to 399.99 nmi. Selectable in 0.01 nmi increments.
Accuracy:	±.02 nmi plus ±0.005% of selected range

VELOCITY:

Range:	0 to 3990 KTS selectable in 10 KT increments
Accuracy:	±.01%

ACCELERATION:

Range:	0 to 399 ft/sec^2 selectable in 1 ft/sec^2 increments
Accuracy:	±0.5 ft/sec^2

SQUITTER:

Range:	Selectable from 10 Hz to 5999 Hz in 1 Hz increments (Average Rate)
Accuracy:	±2% from 200 to 5500 Hz
Distribution:	At 2700 Hz the distribution is in compliance with the requirements presented in ARINC characteristic 568

TACAN SIMULATION (INTERNAL):

AM Modulation Frequencies:	15 Hz and 135 Hz ±.02%
AM Modulation Percent:	21% ±3% (Each component)
Bearing:	-180° Approximately

ECHO PULSE:

Position:	**30 nmi ±1 nmi (X Channel)**
Amplitude:	-19 to +6 dB, selectable in 1 dB increments
Accuracy:	±0.2 dB for -10 dB to +3 dB ±0.5 dB for -19 dB to -11 dB ±0.5 dB for +4 dB to +6 dB

IDENT PULSE:

Rate:	1350 Hz ±.02%

EQUALIZER PULSE:

Position:	100 µs ±10 µs after IDENT pulse

REPLY EFFICIENCY:

Range:	0% to 100% selectable in 10% increments (1% under GPIB Control)
Accuracy:	±0.5% of interrogations
Statistics:	Random

PULSE CHARACTERISTICS:

Spectrum:	>55 dB down from center frequency measured at ±800 kHz.
Spacing:	12 µs ±0.1 µs (X Channel), P_1 to P_2, 50% peak 30 µs ±0.1 µs (Y Channel), P_1 to P_2, 50% peak
P_2 Deviation:	±7.9 µs in 0.1 µs increment (X & Y Channel)
Rise Time:	2.0 ±0.25 µs (10% to 90%)
Fall Time:	2.5 ±0.25 µs (90% to 10%)
Width:	3.5 ±0.5 µs (50% to 50%)

R-NAV PULSE:

Spacing:	50 µs ±0.25 µs at 0 nmi (X Channel) 56 µs ±0.25 µs at 0 nmi (Y Channel) P_1 at time of interrogation P_2 at time of reply

Width:	7 µs ±1 µs
Level:	Logic 0 is 2.8 V ±.2 V Logic 1 is 7.5 V ±.5 V
SERIAL DATA OUTPUT:	ARINC 568 digital receiver test levels
Level:	Logic 0 is 2.8 V ±.2 V Logic 1 is 7.5 V ±.5 V
Clock Frequency:	Adjustable from 7 kHz to 15 kHz
SERIAL DATA INPUT:	Readout front panel, ARINC 568 digital transmitter test levels and load
Schmitt Trigger Level:	Logic 0 is < 1.0 V Logic 1 is >10.0 V
Input Resistance:	1200 Ω ±10%
SCOPE SYNC:	
T_O:	50% of P_1 interrogations
TAC:	15 Hz (coincident with main reference group)
T_D:	3.5 µs before range replies (T_{D_1}) 3.5 µs before generator pulses (T_{D_2}) (Internal switch setting selects either T_{D_1} or T_{D_2})
AUTOMATIC FREQUENCY STEPPING:	
Period:	1 second to 25 seconds adjustable
UUT PULSE SPACING DETECTOR:	Centered at 12 µs for X Channel and 36 µs for Y Channel
Window Width:	1 µs ±.1 µs, referenced to 50% of P_1 for narrow window 4 µs ±.2 µs, referenced to 50% of P_1 for wide window

A-3 TRANSPONDER MODE CHARACTERISTICS:

INTERROGATION RATE:

Range:	10 Hz to 7999 Hz selectable in 1 Hz increments
Accuracy:	±.005%

PULSE CHARACTERISTICS:

RF Frequency Pulling:	<10 kHz
Mode Spacing:	3.0 µs ±5 ns (Mode 1) 5.0 µs ±5 ns (Mode 2) 6.5 µs ±5 ns (Mode T) 8.0 µs ±5 ns (Mode A/Mode 3) 17.0 µs ±5 ns (Mode B) 21.0 µs ±5 ns (Mode C) 25.0 µs ±5 ns (Mode D)
P_2, P_3 Deviation:	±1.85 µs selectable in 0.05 µs increments for both P_2 and P_3 P_2 and P_3 independently variable in direction relative to P_1
Width:	Calibrate 0.8 µs ±5 ns (CAL Switch position) Variable 0.20 µs to 1.85 µs (±5 ns) selectable in 0.05 µs increments (VAR Switch position)
Rise Time:	70 ±20 ns (10% to 90%)
Fall Time:	70 ±20 ns (90% to 10%)

SIDE LOBE SUPPRESSION (SLS):

Amplitude:	-19 to +6 dB, relative to P_1, selectable in 1 dB increments
Accuracy:	±0.2 dB for -10 dB to +3 dB ±0.5 dB for +4 dB to +6 dB ±0.5 dB for -19 dB to -11 dB

INTERFERENCE PULSE:

Amplitude:	-19 to +6 dB relative to P_1 selectable in 1 dB increments
Position Range:	-17.5 µs to 399.0 µs, referenced to P_1 selectable in 0.1 µs increments
Accuracy:	+0.05 µs, -.00 µs
Width:	Adjustable from 0.2 µs to 5 µs

DOUBLE INTERROGATION:

Range:	Measured from P_1 first interrogation to P_1 second interrogation, selectable in 0.1 µs increments
	Minimum: P_3 first interrogation plus 20.5 µs
	Maximum: 399.9 µs
Accuracy:	±5 ns plus .005%

SCOPE SYNC:

T_O:	20 µs before P_1
T_D:	Leading edge of P_3

CAL MARKS:

Accuracy:	±.005%
Phase Adjustment:	>360° at 1.45 µs

UUT PULSE SPACING DETECTOR:

Window Width:	220 ns, nominal for narrow window 750 ns, nominal for wide window
Position:	Centered at 1.45 µs intervals from F_1
Narrow Window Accuracy:	Leading edge from center, 110 ns ±10 ns Trailing edge from center, 110 ns ±10 ns

A-4 UUT MEASUREMENT CHARACTERISTICS:

* TRANSMITTER FREQUENCY COUNTER:

Range:	1020 MHz to 1155 MHz
Accuracy:	±20 kHz (DME Function) ±50 kHz (XPDR Function)

* TRANSMITTER FREQUENCY DISCRIMINATOR OUTPUT:

Response:	1 MHz/volt ±10% into an open load 2 MHz/volt ±10% into a 50Ω load
Bandwidth:	10 MHz minimum

* TRANSMITTER POWER METER:

Frequency Range:	1020 MHz to 1155 MHz
Amplitude Range:	50 W to 2.0 KW peak
Accuracy:	±0.5 dB from a 50Ω source
Input Impedence:	50Ω , VSWR <1.20:1

DME PRF:

Range:	0 to 9999 Hz
Accuracy:	±.01% plus +1, -0 Counts (1 Hz Resolution)

XPDR PERCENT REPLY:

Range:	0 to 159%
Accuracy:	+1, -0 Counts (1% Resolution)

* Measurement of F_1/P_1 or F_2/P_2.

A-5 GENERAL:

POWER REQUIREMENTS:	105 to 120 VAC or 220 to 250 VAC, 50 to 400 Hz
POWER CONSUMPTION:	Less than 100 Watts

SPECIFICATIONS AND FEATURES SUBJECT TO CHANGE WITHOUT NOTICE.

APPENDIX B: MULTILINE INTERFACE MESSAGES: ISO CODE REPRESENTATION

b7 b6 b5 Bits ②
b4 b3 b2 b1 ROW COLUMN
MSG①
0 1 2 3 4 5 6 7
NUL SOH STX ETX EOT ENQ ACK BEL BS HT LF VT FF CR SO SI
DLE DC1 DC2 DC3 DC4 NAK SYN ETB CAN EM SUB ESC FS GS RS US
GTL LLO DCL PPU SDC PPC GET TCT SPE SPD
SP ! " # $ % & ( ) * + / - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [\ ] ^ —
a b c d e f g h i j k l m n o
p q r s t u v w x y z { | } ~ DEL
MLA ASSIGNED TO DEVICE
MEANING DEFINED BY PCG CODE
UNL UNT
ADDRESSED COMMAND GROUP (ACG)
UNIVERSAL COMMAND GROUP (UCG)
LISTEN ADDRESS GROUP (LAG)
TALK ADDRESS GROUP (TAG)
SECONDARY COMMAND GROUP (SCG)
PRIMARY COMMAND GROUP (PCG)
④

NOTES: ① MSG=INTERFACE MESSAGE
② $b_1 = DIO1 \ldots b_7 = DIO7$
③ REQUIRES SECONDARY COMMAND
④ DENISE SUBSET (COLUMN 2 THROUGH 5)

APPENDIX C: DME CHANNELING AND VHF FREQUENCY PAIRING (SHEET 1 OF 7)

TACAN Channel Spacing	VHF Channel MHz	Airborne DME Transmitter Frequency (MHz)	Spacing (μ sec)	Ground Station Transmitter Frequency (MHz)	Spacing (μ sec)
1X	134.40	1025	12	962	12
1Y	134.45	1025	36	1088	30
2X	134.50	1026	12	963	12
2Y	134.55	1026	36	1089	30
3X	134.60	1027	12	964	12
3Y	134.65	1027	36	1090	30
4X	134.70	1028	12	965	12
4Y	134.75	1028	36	1091	30
5X	134.80	1029	12	966	12
5Y	134.85	1029	36	1092	30
6X	134.90	1030	12	967	12
6Y	134.95	1030	36	1093	30
7X	135.00	1031	12	968	12
7Y	135.05	1031	36	1094	30
8X	135.10	1032	12	969	12
8Y	135.15	1032	36	1095	30
9X	135.20	1033	12	970	12
9Y	135.25	1033	36	1096	30
10X	135.30	1034	12	971	12
10Y	135.35	1034	36	1097	30
11X	135.40	1035	12	972	12
11Y	135.45	1035	36	1098	30
12X	135.50	1036	12	973	12
12Y	135.55	1036	36	1099	30
13X	135.60	1037	12	974	12
13Y	135.65	1037	36	1100	30
14X	135.70	1038	12	975	12
14Y	135.75	1038	36	1101	30
15X	135.80	1039	12	976	12
15Y	135.85	1039	36	1102	30
16X	135.90	1040	12	977	12
16Y	135.95	1040	36	1103	30
17X	108.00	1041	12	978	12
17Y	108.05	1041	36	1104	30
18X	108.10	1042	12	979	12
18Y	108.15	1042	36	1105	30

APPENDIX C: DME CHANNELING AND VHF FREQUENCY PAIRING
(Sheet 2 of 7)

TACAN Channel Spacing	VHF Channel MHz	Airborne DME Transmitter Frequency (MHz)	Spacing (μ sec)	Ground Station Transmitter Frequency (MHz)	Spacing (μ sec)
19X	108.20	1043	12	980	12
19Y	108.25	1043	36	1106	30
20X	108.30	1044	12	981	12
20Y	108.35	1044	36	1107	30
21X	108.40	1045	12	982	12
21Y	108.45	1045	36	1108	30
22X	108.50	1046	12	983	12
22Y	108.55	1046	36	1109	30
23X	108.60	1047	12	984	12
23Y	108.65	1047	36	1110	30
24X	108.70	1048	12	985	12
24Y	108.75	1048	36	1111	30
25X	108.80	1049	12	986	12
25Y	108.85	1049	36	1112	30
26X	108.90	1050	12	987	12
26Y	108.95	1050	36	1113	30
27X	109.00	1051	12	988	12
27Y	109.05	1051	36	1114	30
28X	109.10	1052	12	989	12
28Y	109.15	1052	36	1115	30
29X	109.20	1053	12	990	12
29Y	109.25	1053	36	1116	30
30X	109.30	1054	12	991	12
30Y	109.35	1054	36	1117	30
31X	109.40	1055	12	992	12
31Y	109.45	1055	36	1118	30
32X	109.50	1056	12	993	12
32Y	109.55	1056	36	1119	30
33X	109.60	1057	12	994	12
33Y	109.65	1057	36	1120	30
34X	109.70	1058	12	995	12
34Y	109.75	1058	36	1121	30
35X	109.80	1059	12	996	12
35Y	109.85	1059	36	1122	30
36X	109.90	1060	12	997	12
36Y	109.95	1060	36	1123	30

APPENDIX C: DME CHANNELING AND VHF FREQUENCY PAIRING
(Sheet 3 of 7)

TACAN Channel Spacing	VHF Channel MHz	Airborne DME Transmitter Frequency (MHz)	Spacing (μ sec)	Ground Station Transmitter Frequency (MHz)	Spacing (μ sec)
37X	110.00	1061	12	998	12
37Y	110.05	1061	36	1124	30
38X	110.10	1062	12	999	12
38Y	110.15	1062	36	1125	30
39X	110.20	1063	12	1000	12
39Y	110.25	1063	36	1126	30
40X	110.30	1064	12	1001	12
40Y	110.35	1064	36	1127	30
41X	110.40	1065	12	1002	12
41Y	110.45	1065	36	1128	30
42X	110.50	1066	12	1003	12
42Y	110.55	1066	36	1129	30
43X	110.60	1067	12	1004	12
43Y	110.65	1067	36	1130	30
44X	110.70	1068	12	1005	12
44Y	110.75	1068	36	1131	30
45X	110.80	1069	12	1006	12
45Y	110.85	1069	36	1132	30
46X	110.90	1070	12	1007	12
46Y	110.95	1070	36	1133	30
47X	111.00	1071	12	1008	12
47Y	111.05	1071	36	1134	30
48X	111.10	1072	12	1009	12
48Y	111.15	1072	36	1135	30
49X	111.20	1073	12	1010	12
49Y	111.25	1073	36	1136	30
50X	111.30	1074	12	1011	12
50Y	111.35	1074	36	1137	30
51X	111.40	1075	12	1012	12
51Y	111.45	1075	36	1138	30
52X	111.50	1076	12	1013	12
52Y	111.55	1076	36	1139	30
53X	111.60	1077	12	1014	12
53Y	111.65	1077	36	1140	30
54X	111.70	1078	12	1015	12
54Y	111.75	1078	36	1141	30

APPENDIX C: DME CHANNELING AND VHF FREQUENCY PAIRING
(Sheet 4 of 7)

TACAN Channel Spacing	VHF Channel MHz	Airborne DME Transmitter Frequency (MHz)	Spacing (μ sec)	Ground Station Transmitter Frequency (MHz)	Spacing (μ sec)
55X	111.80	1079	12	1016	12
55Y	111.85	1079	36	1142	30
56X	111.90	1080	12	1017	12
56Y	111.95	1080	36	1143	30
57X	112.00	1081	12	1018	12
57Y	112.05	1081	36	1144	30
58X	112.10	1082	12	1019	12
58Y	112.15	1082	36	1145	30
59X	112.20	1083	12	1020	12
59Y	112.25	1083	36	1146	30
60X	133.30	1084	12	1021	12
60Y	133.35	1084	36	1147	30
61X	133.40	1085	12	1022	12
61Y	133.45	1085	36	1148	30
62X	133.50	1086	12	1023	12
62Y	133.55	1086	36	1149	30
63X	133.60	1087	12	1024	12
63Y	133.65	1087	36	1150	30
64X	133.70	1088	12	1151	12
64Y	133.75	1088	36	1025	30
65X	133.80	1089	12	1152	12
65Y	133.85	1089	36	1026	30
66X	133.90	1090	12	1153	12
66Y	133.95	1090	36	1027	30
67X	134.00	1091	12	1028	12
67Y	134.05	1091	36	1154	30
68X	134.10	1092	12	1155	12
68Y	134.15	1092	36	1029	30
69X	134.20	1093	12	1156	12
69Y	134.25	1093	36	1030	30
70X	112.30	1094	12	1157	12
70Y	112.35	1094	36	1031	30
71X	112.40	1095	12	1158	12
71Y	112.45	1095	36	1032	30
72X	112.50	1096	12	1159	12
72Y	112.55	1096	36	1033	30

APPENDIX C: DME CHANNELING AND VHF FREQUENCY PAIRING
(Sheet 5 of 7)

TACAN Channel Spacing	VHF Channel MHz	Airborne DME Transmitter Frequency (MHz)	Spacing (μ sec)	Ground Station Transmitter Frequency (MHz)	Spacing (μ sec)
73X	112.60	1097	12	1160	12
73Y	112.65	1097	36	1034	30
74X	112.70	1098	12	1161	12
74Y	112.75	1098	36	1035	30
75X	112.80	1099	12	1162	12
75Y	112.85	1099	36	1036	30
76X	112.90	1100	12	1163	12
76Y	112.95	1100	36	1037	30
77X	113.00	1101	12	1164	12
77Y	113.05	1101	36	1038	30
78X	113.10	1102	12	1165	12
78Y	113.15	1102	36	1039	30
79X	113.25	1103	12	1166	12
79Y	113.25	1103	36	1040	30
80X	113.30	1104	12	1167	12
80Y	113.35	1104	36	1041	30
81X	113.40	1105	12	1168	12
81Y	113.45	1105	36	1042	30
82X	113.50	1106	12	1169	12
82Y	113.55	1106	36	1043	30
83X	113.60	1107	12	1170	12
83Y	113.65	1107	36	1044	30
84X	113.70	1108	12	1171	12
84Y	113.75	1108	36	1045	30
85X	113.80	1109	12	1172	12
85Y	113.85	1109	36	1046	30
86X	113.90	1110	12	1173	12
86Y	113.95	1110	36	1047	30
87X	114.00	1111	12	1174	12
87Y	114.05	1111	36	1048	30
88X	114.10	1112	12	1175	12
88Y	114.15	1112	36	1049	30
89X	114.20	1113	12	1176	12
89Y	114.25	1113	36	1050	30
90X	114.30	1114	12	1177	12
90Y	114.35	1114	36	1051	30

APPENDIX C: DME CHANNELING AND VHF FREQUENCY PAIRING
(Sheet 6 of 7)

TACAN Channel Spacing	VHF Channel MHz	Airborne DME Transmitter Frequency (MHz)	Spacing (μ sec)	Ground Station Transmitter Frequency (MHz)	Spacing (μ sec)
91X	114.40	1115	12	1178	12
91Y	114.45	1115	36	1052	30
92X	114.50	1116	12	1179	12
92Y	114.55	1116	36	1053	30
93X	114.60	1117	12	1180	12
93Y	114.65	1117	36	1054	30
94X	114.70	1118	12	1181	12
94Y	114.75	1118	36	1055	30
95X	114.80	1119	12	1182	12
95Y	114.85	1119	36	1056	30
96X	114.90	1120	12	1183	12
96Y	114.95	1120	36	1057	30
97X	114.00	1121	12	1184	12
97Y	115.05	1121	36	1058	30
98X	115.10	1122	12	1185	12
98Y	115.15	1122	36	1059	30
99X	115.20	1123	12	1186	12
99Y	115.25	1123	36	1060	30
100X	115.30	1124	12	1187	12
100Y	115.35	1124	36	1061	30
101X	115.40	1125	12	1188	12
101Y	115.45	1125	36	1062	30
102X	115.50	1126	12	1189	12
102Y	115.55	1126	36	1063	30
103X	115.60	1127	12	1190	12
103Y	115.65	1127	36	1064	30
104X	115.70	1128	12	1191	12
104Y	115.75	1128	36	1065	30
105X	115.80	1129	12	1192	12
105Y	115.85	1129	36	1066	30
106X	115.90	1130	12	1193	12
106Y	115.95	1130	36	1067	30
107X	116.00	1131	12	1194	12
107Y	116.05	1131	36	1068	30
108X	116.10	1132	12	1195	12
108Y	116.15	1132	36	1069	30

APPENDIX C: DME CHANNELING AND VHF FREQUENCY PAIRING
(Sheet 7 of 7)

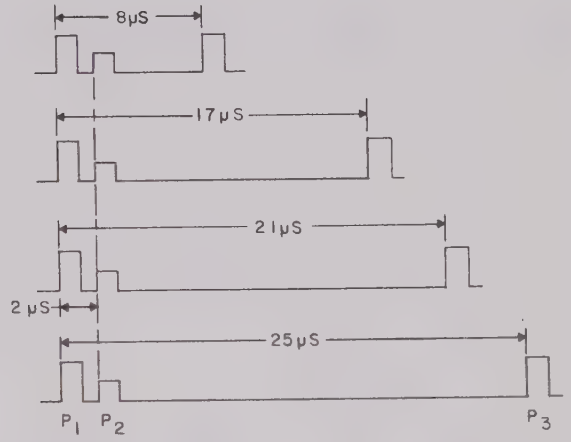
TACAN Channel Spacing	VHF Channel MHz	Airborne DME Transmitter Frequency (MHz)	Spacing (μ sec)	Ground Station Transmitter Frequency (MHz)	Spacing (μ sec)
109X	116.20	1133	12	1196	12
109Y	116.25	1133	36	1070	30
110X	116.30	1134	12	1197	12
110Y	116.35	1134	36	1071	30
111X	116.40	1135	12	1198	12
111Y	116.45	1135	36	1072	30
112X	116.50	1136	12	1199	12
112Y	116.55	1136	36	1073	30
113X	116.60	1137	12	1200	12
113Y	116.65	1137	36	1074	30
114X	116.70	1138	12	1201	12
114Y	116.75	1138	36	1075	30
115X	116.80	1139	12	1202	12
115Y	116.85	1139	36	1076	30
116X	116.90	1140	12	1203	12
116Y	116.95	1140	36	1077	30
117X	117.00	1141	12	1204	12
117Y	117.05	1141	36	1078	30
118X	117.10	1142	12	1205	12
118Y	117.15	1142	36	1079	30
119X	117.20	1143	12	1206	12
119Y	117.25	1143	36	1080	30
120X	117.30	1144	12	1207	12
120Y	117.35	1144	36	1081	30
121X	117.40	1145	12	1208	12
121Y	117.45	1145	36	1082	30
122X	117.50	1146	12	1209	12
122Y	117.55	1146	36	1083	30
123X	117.60	1147	12	1210	12
123Y	117.65	1147	36	1084	30
124X	117.70	1148	12	1211	12
124Y	117.75	1148	36	1085	30
125X	117.80	1149	12	1212	12
125Y	117.85	1149	36	1086	30
126X	117.90	1150	12	1213	12
126Y	117.95	1150	36	1087	30

APPENDIX D: AIR TRAFFIC CONTROL RADAR BEACON SYSTEM INTERROGATION MODES AND TRANSPONDER CODES

D-1 ATCRBS INTERROGATION MODES

MODE ATTRACTION

3/A	COMMON (ATC)	
B	CIVIL (ATC)	(NOT REQUIRED FOR U.S. OPERATION)
C	CIVIL (ALTITUDE)	
D	CIVIL (UNASSIGNED)	



D-2 TRANSPONDER REPLY CODES

MODE 3/A

SPACING (μS) LEADING EDGE TO LEADING EDGE	0	1.45	2.9	4.35	5.8	7.25	8.7	10.15	11.6	13.05	14.5	15.95	17.4	18.85	20.3
PULSE NOMENCLATURE	F_1	C_1	A_1	C_2	A_2	C_4	A_4	X	B_1	D_1	B_2	D_2	B_4	D_4	F_2

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
(SHEET 1 OF 37)

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
-1.0	0	0	0	0	0	0	0	0	0	1	0
-0.9	0	0	0	0	0	0	0	0	1	1	0
-0.8	0	0	0	0	0	0	0	0	1	0	0
-0.7	0	0	0	0	0	0	0	1	1	0	0
-0.6	0	0	0	0	0	0	0	1	1	1	0
-0.5	0	0	0	0	0	0	0	1	0	1	0
-0.4	0	0	0	0	0	0	0	1	0	1	1
-0.3	0	0	0	0	0	0	0	1	0	0	1
-0.2	0	0	0	0	0	0	1	1	0	0	1
-0.1	0	0	0	0	0	0	1	1	0	1	1
0.0	0	0	0	0	0	0	1	1	0	1	0
0.1	0	0	0	0	0	0	1	1	1	1	0
0.2	0	0	0	0	0	0	1	1	1	0	0
0.3	0	0	0	0	0	0	1	0	1	0	0
0.4	0	0	0	0	0	0	1	0	1	1	0
0.5	0	0	0	0	0	0	1	0	0	1	0
0.6	0	0	0	0	0	0	1	0	0	1	1
0.7	0	0	0	0	0	0	1	0	0	0	1
0.8	0	0	0	0	0	1	1	0	0	0	1
0.9	0	0	0	0	0	1	1	0	0	1	1
1.0	0	0	0	0	0	1	1	0	0	1	0
1.1	0	0	0	0	0	1	1	0	1	1	0
1.2	0	0	0	0	0	1	1	0	1	0	0
1.3	0	0	0	0	0	1	1	1	1	0	0
1.4	0	0	0	0	0	1	1	1	1	1	0
1.5	0	0	0	0	0	1	1	1	0	1	0
1.6	0	0	0	0	0	1	1	1	0	1	1
1.7	0	0	0	0	0	1	1	1	0	0	1
1.8	0	0	0	0	0	1	0	1	0	0	1
1.9	0	0	0	0	0	1	0	1	0	1	1
2.0	0	0	0	0	0	1	0	1	0	1	0
2.1	0	0	0	0	0	1	0	1	1	1	0
2.2	0	0	0	0	0	1	0	1	1	0	0

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
(Sheet 2 of 37)

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
2.3	0	0	0	0	0	1	0	0	1	0	0
2.4	0	0	0	0	0	1	0	0	1	1	0
2.5	0	0	0	0	0	1	0	0	0	1	0
2.6	0	0	0	0	0	1	0	0	0	1	1
2.7	0	0	0	0	0	1	0	0	0	0	1
2.8	0	0	0	0	1	1	0	0	0	0	1
2.9	0	0	0	0	1	1	0	0	0	1	1
3.0	0	0	0	0	1	1	0	0	0	1	0
3.1	0	0	0	0	1	1	0	0	1	1	0
3.2	0	0	0	0	1	1	0	0	1	0	0
3.3	0	0	0	0	1	1	0	1	1	0	0
3.4	0	0	0	0	1	1	0	1	1	1	0
3.5	0	0	0	0	1	1	0	1	0	1	0
3.6	0	0	0	0	1	1	0	1	0	1	1
3.7	0	0	0	0	1	1	0	1	0	0	1
3.8	0	0	0	0	1	1	1	1	0	0	1
3.9	0	0	0	0	1	1	1	1	0	1	1
4.0	0	0	0	0	1	1	1	1	0	1	0
4.1	0	0	0	0	1	1	1	1	1	1	0
4.2	0	0	0	0	1	1	1	1	1	0	0
4.3	0	0	0	0	1	1	1	0	1	0	0
4.4	0	0	0	0	1	1	1	0	1	1	0
4.5	0	0	0	0	1	1	1	0	0	1	0
4.6	0	0	0	0	1	1	1	0	0	1	1
4.7	0	0	0	0	1	1	1	0	0	0	1
4.8	0	0	0	0	1	0	1	0	0	0	1
4.9	0	0	0	0	1	0	1	0	0	1	1
5.0	0	0	0	0	1	0	1	0	0	1	0
5.1	0	0	0	0	1	0	1	0	1	1	0
5.2	0	0	0	0	1	0	1	0	1	0	0
5.3	0	0	0	0	1	0	1	1	1	0	0
5.4	0	0	0	0	1	0	1	1	1	1	0
5.5	0	0	0	0	1	0	1	1	0	1	0
5.6	0	0	0	0	1	0	1	1	0	1	1
5.7	0	0	0	0	1	0	1	1	0	0	1

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
(Sheet 3 of 37)

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
5.8	0	0	0	0	1	0	0	1	0	0	1
5.9	0	0	0	0	1	0	0	1	0	1	1
6.0	0	0	0	0	1	0	0	1	0	1	0
6.1	0	0	0	0	1	0	0	1	1	1	0
6.2	0	0	0	0	1	0	0	1	1	0	0
6.3	0	0	0	0	1	0	0	0	1	0	0
6.4	0	0	0	0	1	0	0	0	1	1	0
6.5	0	0	0	0	1	0	0	0	0	1	0
6.6	0	0	0	0	1	0	0	0	0	1	1
6.7	0	0	0	0	1	0	0	0	0	0	1
6.8	0	0	0	1	1	0	0	0	0	0	1
6.9	0	0	0	1	1	0	0	0	0	1	1
7.0	0	0	0	1	1	0	0	0	0	1	0
7.1	0	0	0	1	1	0	0	0	1	1	0
7.2	0	0	0	1	1	0	0	0	1	0	0
7.3	0	0	0	1	1	0	0	1	1	0	0
7.4	0	0	0	1	1	0	0	1	1	1	0
7.5	0	0	0	1	1	0	0	1	0	1	0
7.6	0	0	0	1	1	0	0	1	0	1	1
7.7	0	0	0	1	1	0	0	1	0	0	1
7.8	0	0	0	1	1	0	1	1	0	0	1
7.9	0	0	0	1	1	0	1	1	0	1	1
8.0	0	0	0	1	1	0	1	1	0	1	0
8.1	0	0	0	1	1	0	1	1	1	1	0
8.2	0	0	0	1	1	0	1	1	1	0	0
8.3	0	0	0	1	1	0	1	0	1	0	0
8.4	0	0	0	1	1	0	1	0	1	1	0
8.5	0	0	0	1	1	0	1	0	0	1	0
8.6	0	0	0	1	1	0	1	0	0	1	1
8.7	0	0	0	1	1	0	1	0	0	0	1
8.8	0	0	0	1	1	1	1	0	0	0	1
8.9	0	0	0	1	1	1	1	0	0	1	1
9.0	0	0	0	1	1	1	1	0	0	1	0
9.1	0	0	0	1	1	1	1	0	1	1	0
9.2	0	0	0	1	1	1	1	0	1	0	0

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
9.3	0	0	0	1	1	1	1	1	1	0	0
9.4	0	0	0	1	1	1	1	1	1	1	0
9.5	0	0	0	1	1	1	1	1	0	1	0
9.6	0	0	0	1	1	1	1	1	0	1	1
9.7	0	0	0	1	1	1	1	1	0	0	1
9.8	0	0	0	1	1	1	0	1	0	0	1
9.9	0	0	0	1	1	1	0	1	0	1	1
10.0	0	0	0	1	1	1	0	1	0	1	0
10.1	0	0	0	1	1	1	0	1	1	1	0
10.2	0	0	0	1	1	1	0	1	1	0	0
10.3	0	0	0	1	1	1	0	0	1	0	0
10.4	0	0	0	1	1	1	0	0	1	1	0
10.5	0	0	0	1	1	1	0	0	0	1	0
10.6	0	0	0	1	1	1	0	0	0	1	1
10.7	0	0	0	1	1	1	0	0	0	0	1
10.8	0	0	0	1	0	1	0	0	0	0	1
10.9	0	0	0	1	0	1	0	0	0	1	1
11.0	0	0	0	1	0	1	0	0	0	1	0
11.1	0	0	0	1	0	1	0	0	1	1	0
11.2	0	0	0	1	0	1	0	0	1	0	0
11.3	0	0	0	1	0	1	0	1	1	0	0
11.4	0	0	0	1	0	1	0	1	1	1	0
11.5	0	0	0	1	0	1	0	1	0	1	0
11.6	0	0	0	1	0	1	0	1	0	1	1
11.7	0	0	0	1	0	1	0	1	0	0	1
11.8	0	0	0	1	0	1	1	1	0	0	1
11.9	0	0	0	1	0	1	1	1	0	1	1
12.0	0	0	0	1	0	1	1	1	0	1	0
12.1	0	0	0	1	0	1	1	1	1	1	0
12.2	0	0	0	1	0	1	1	1	1	0	0
12.3	0	0	0	1	0	1	1	0	1	0	0
12.4	0	0	0	1	0	1	1	0	1	1	0
12.5	0	0	0	1	0	1	1	0	0	1	0
12.6	0	0	0	1	0	1	1	0	0	1	1
12.7	0	0	0	1	0	1	1	0	0	0	1

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
12.8	0	0	0	1	0	0	1	0	0	0	1
12.9	0	0	0	1	0	0	1	0	0	1	1
13.0	0	0	0	1	0	0	1	0	0	1	0
13.1	0	0	0	1	0	0	1	0	1	1	0
13.2	0	0	0	1	0	0	1	0	1	0	0
13.3	0	0	0	1	0	0	1	1	1	0	0
13.4	0	0	0	1	0	0	1	1	1	1	0
13.5	0	0	0	1	0	0	1	1	0	1	0
13.6	0	0	0	1	0	0	1	1	0	1	1
13.7	0	0	0	1	0	0	1	1	0	0	1
13.8	0	0	0	1	0	0	0	1	0	0	1
13.9	0	0	0	1	0	0	0	1	0	1	1
14.0	0	0	0	1	0	0	0	1	0	1	0
14.1	0	0	0	1	0	0	0	1	1	1	0
14.2	0	0	0	1	0	0	0	1	1	0	0
14.3	0	0	0	1	0	0	0	0	1	0	0
14.4	0	0	0	1	0	0	0	0	1	1	0
14.5	0	0	0	1	0	0	0	0	0	1	0
14.6	0	0	0	1	0	0	0	0	0	1	1
14.7	0	0	0	1	0	0	0	0	0	0	1
14.8	0	0	1	1	0	0	0	0	0	0	1
14.9	0	0	1	1	0	0	0	0	0	1	1
15.0	0	0	1	1	0	0	0	0	0	1	0
15.1	0	0	1	1	0	0	0	0	1	1	0
15.2	0	0	1	1	0	0	0	0	1	0	0
15.3	0	0	1	1	0	0	0	1	1	0	0
15.4	0	0	1	1	0	0	0	1	1	1	0
15.5	0	0	1	1	0	0	0	1	0	1	0
15.6	0	0	1	1	0	0	0	1	0	1	1
15.7	0	0	1	1	0	0	0	1	0	0	1
15.8	0	0	1	1	0	0	1	1	0	0	1
15.9	0	0	1	1	0	0	1	1	0	1	1
16.0	0	0	1	1	0	0	1	1	0	1	0
16.1	0	0	1	1	0	0	1	1	1	1	0
16.2	0	0	1	1	0	0	1	1	1	0	0

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
16.3	0	0	1	1	0	0	1	0	1	0	0
16.4	0	0	1	1	0	0	1	0	1	1	0
16.5	0	0	1	1	0	0	1	0	0	1	0
16.6	0	0	1	1	0	0	1	0	0	1	1
16.7	0	0	1	1	0	0	1	0	0	0	1
16.8	0	0	1	1	0	1	1	0	0	0	1
16.9	0	0	1	1	0	1	1	0	0	1	1
17.0	0	0	1	1	0	1	1	0	0	1	0
17.1	0	0	1	1	0	1	1	0	1	1	0
17.2	0	0	1	1	0	1	1	0	1	0	0
17.3	0	0	1	1	0	1	1	1	1	0	0
17.4	0	0	1	1	0	1	1	1	1	1	0
17.5	0	0	1	1	0	1	1	1	0	1	0
17,6	0	0	1	1	0	1	1	1	0	1	1
17.7	0	0	1	1	0	1	1	1	0	0	1
17.8	0	0	1	1	0	1	0	1	0	0	1
17.9	0	0	1	1	0	1	0	1	0	1	1
18.0	0	0	1	1	0	1	0	1	0	1	0
18.1	0	0	1	1	0	1	0	1	1	1	0
18.2	0	0	1	1	0	1	0	1	1	0	0
18.3	0	0	1	1	0	1	0	0	1	0	0
18.4	0	0	1	1	0	1	0	0	1	1	0
18.5	0	0	1	1	0	1	0	0	0	1	0
18.6	0	0	1	1	0	1	0	0	0	1	1
18.7	0	0	1	1	0	1	0	0	0	0	1
18.8	0	0	1	1	1	1	0	0	0	0	1
18.9	0	0	1	1	1	1	0	0	0	1	1
19.0	0	0	1	1	1	1	0	0	0	1	0
19.1	0	0	1	1	1	1	0	0	1	1	0
19.2	0	0	1	1	1	1	0	0	1	0	0
19.3	0	0	1	1	1	1	0	1	1	0	0
19.4	0	0	1	1	1	1	0	1	1	1	0
19.5	0	0	1	1	1	1	0	1	0	1	0
19.6	0	0	1	1	1	1	0	1	0	1	1
19.7	0	0	1	1	1	1	0	1	0	0	1

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
19.8	0	0	1	1	1	1	1	1	0	0	1
19.9	0	0	1	1	1	1	1	1	0	1	1
20.0	0	0	1	1	1	1	1	1	0	1	0
20.1	0	0	1	1	1	1	1	1	1	1	0
20.2	0	0	1	1	1	1	1	1	1	0	0
20.3	0	0	1	1	1	1	1	0	1	0	0
20.4	0	0	1	1	1	1	1	0	1	1	0
20.5	0	0	1	1	1	1	1	0	0	1	0
20.6	0	0	1	1	1	1	1	0	0	1	1
20.7	0	0	1	1	1	1	1	0	0	0	1
20.8	0	0	1	1	1	0	1	0	0	0	1
20.9	0	0	1	1	1	0	1	0	0	1	1
21.0	0	0	1	1	1	0	1	0	0	1	0
21.1	0	0	1	1	1	0	1	0	1	1	0
21.2	0	0	1	1	1	0	1	0	1	0	0
21.3	0	0	1	1	1	0	1	1	1	0	0
21.4	0	0	1	1	1	0	1	1	1	1	0
21.5	0	0	1	1	1	0	1	1	0	1	0
21.6	0	0	1	1	1	0	1	1	0	1	1
21.7	0	0	1	1	1	0	1	1	0	0	1
21.8	0	0	1	1	1	0	0	1	0	0	1
21.9	0	0	1	1	1	0	0	1	0	1	1
22.0	0	0	1	1	1	0	0	1	0	1	0
22.1	0	0	1	1	1	0	0	1	1	1	0
22.2	0	0	1	1	1	0	0	1	1	0	0
22.3	0	0	1	1	1	0	0	0	1	0	0
22.4	0	0	1	1	1	0	0	0	1	1	0
22.5	0	0	1	1	1	0	0	0	0	1	0
22.6	0	0	1	1	1	0	0	0	0	1	1
22.7	0	0	1	1	1	0	0	0	0	0	1
22.8	0	0	1	0	1	0	0	0	0	0	1
22.9	0	0	1	0	1	0	0	0	0	1	1
23.0	0	0	1	0	1	0	0	0	0	1	0
23.1	0	0	1	0	1	0	0	0	1	1	0
23.2	0	0	1	0	1	0	0	0	1	0	0

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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
23.3	0	0	1	0	1	0	0	1	1	0	0
23.4	0	0	1	0	1	0	0	1	1	1	0
23.5	0	0	1	0	1	0	0	1	0	1	0
23.6	0	0	1	0	1	0	0	1	0	1	1
23.7	0	0	1	0	1	0	0	1	0	0	1
23.8	0	0	1	0	1	0	1	1	0	0	1
23.9	0	0	1	0	1	0	1	1	0	1	1
24.0	0	0	1	0	1	0	1	1	0	1	0
24.1	0	0	1	0	1	0	1	1	1	1	0
24.2	0	0	1	0	1	0	1	1	1	0	0
24.3	0	0	1	0	1	0	1	0	1	0	0
24.4	0	0	1	0	1	0	1	0	1	1	0
24.5	0	0	1	0	1	0	1	0	0	1	0
24.6	0	0	1	0	1	0	1	0	0	1	1
24.7	0	0	1	0	1	0	1	0	0	0	1
24.8	0	0	1	0	1	1	1	0	0	0	1
24.9	0	0	1	0	1	1	1	0	0	1	1
25.0	0	0	1	0	1	1	1	0	0	1	0
25.1	0	0	1	0	1	1	1	0	1	1	0
25.2	0	0	1	0	1	1	1	0	1	0	0
25.3	0	0	1	0	1	1	1	1	1	0	0
25.4	0	0	1	0	1	1	1	1	1	1	0
25.5	0	0	1	0	1	1	1	1	0	1	0
25.6	0	0	1	0	1	1	1	1	0	1	1
25.7	0	0	1	0	1	1	1	1	0	0	1
25.8	0	0	1	0	1	1	0	1	0	0	1
25.9	0	0	1	0	1	1	0	1	0	1	1
26.0	0	0	1	0	1	1	0	1	0	1	0
26.1	0	0	1	0	1	1	0	1	1	1	0
26.2	0	0	1	0	1	1	0	1	1	0	0
26.3	0	0	1	0	1	1	0	0	1	0	0
26.4	0	0	1	0	1	1	0	0	1	1	0
26.5	0	0	1	0	1	1	0	0	0	1	0
26.6	0	0	1	0	1	1	0	0	0	1	1
26.7	0	0	1	0	1	1	0	0	0	0	1

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
26.8	0	0	1	0	0	1	0	0	0	0	1
26.9	0	0	1	0	0	1	0	0	0	1	1
27.0	0	0	1	0	0	1	0	0	0	1	0
27.1	0	0	1	0	0	1	0	0	1	1	0
27.2	0	0	1	0	0	1	0	0	1	0	0
27.3	0	0	1	0	0	1	0	1	1	0	0
27.4	0	0	1	0	0	1	0	1	1	1	0
27.5	0	0	1	0	0	1	0	1	0	1	0
27.6	0	0	1	0	0	1	0	1	0	1	1
27.7	0	0	1	0	0	1	0	1	0	0	1
27.8	0	0	1	0	0	1	1	1	0	0	1
27.9	0	0	1	0	0	1	1	1	0	1	1
28.0	0	0	1	0	0	1	1	1	0	1	0
28.1	0	0	1	0	0	1	1	1	1	1	0
28.2	0	0	1	0	0	1	1	1	1	0	0
28.3	0	0	1	0	0	1	1	0	1	0	0
28.4	0	0	1	0	0	1	1	0	1	1	0
28.5	0	0	1	0	0	1	1	0	0	1	0
28.6	0	0	1	0	0	1	1	0	0	1	1
28.7	0	0	1	0	0	1	1	0	0	0	1
28.8	0	0	1	0	0	0	1	0	0	0	1
28.9	0	0	1	0	0	0	1	0	0	1	1
29.0	0	0	1	0	0	0	1	0	0	1	0
29.1	0	0	1	0	0	0	1	0	1	1	0
29.2	0	0	1	0	0	0	1	0	1	0	0
29.3	0	0	1	0	0	0	1	1	1	0	0
29.4	0	0	1	0	0	0	1	1	1	1	0
29.5	0	0	1	0	0	0	1	1	0	1	0
29.6	0	0	1	0	0	0	1	1	0	1	1
29.7	0	0	1	0	0	0	1	1	0	0	1
29.8	0	0	1	0	0	0	0	1	0	0	1
29.9	0	0	1	0	0	0	0	1	0	1	1
30.0	0	0	1	0	0	0	0	1	0	1	0
30.1	0	0	1	0	0	0	0	1	1	1	0
30.2	0	0	1	0	0	0	0	1	1	0	0

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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
30.3	0	0	1	0	0	0	0	0	1	0	0
30.4	0	0	1	0	0	0	0	0	1	1	0
30.5	0	0	1	0	0	0	0	0	0	1	0
30.6	0	0	1	0	0	0	0	0	0	1	1
30.7	0	0	1	0	0	0	0	0	0	0	1
30.8	0	1	1	0	0	0	0	0	0	0	1
30.9	0	1	1	0	0	0	0	0	0	1	1
31.0	0	1	1	0	0	0	0	0	0	1	0
31.1	0	1	1	0	0	0	0	0	1	1	0
31.2	0	1	1	0	0	0	0	0	1	0	0
31.3	0	1	1	0	0	0	0	1	1	0	0
31.4	0	1	1	0	0	0	0	1	1	1	0
31.5	0	1	1	0	0	0	0	1	0	1	0
31.6	0	1	1	0	0	0	0	1	0	1	1
31.7	0	1	1	0	0	0	0	1	0	0	1
31.8	0	1	1	0	0	0	1	1	0	0	1
31.9	0	1	1	0	0	0	1	1	0	1	1
32.0	0	1	1	0	0	0	1	1	0	1	0
32.1	0	1	1	0	0	0	1	1	1	1	0
32.2	0	1	1	0	0	0	1	1	1	0	0
32.3	0	1	1	0	0	0	1	0	1	0	0
32.4	0	1	1	0	0	0	1	0	1	1	0
32.5	0	1	1	0	0	0	1	0	0	1	0
32.6	0	1	1	0	0	0	1	0	0	1	1
32.7	0	1	1	0	0	0	1	0	0	0	1
32.8	0	1	1	0	0	1	1	0	0	0	1
32.9	0	1	1	0	0	1	1	0	0	1	1
33.0	0	1	1	0	0	1	1	0	0	1	0
33.1	0	1	1	0	0	1	1	0	1	1	0
33.2	0	1	1	0	0	1	1	0	1	0	0
33.3	0	1	1	0	0	1	1	1	1	0	0
33.4	0	1	1	0	0	1	1	1	1	1	0
33.5	0	1	1	0	0	1	1	1	0	1	0
33.6	0	1	1	0	0	1	1	1	0	1	1
33.7	0	1	1	0	0	1	1	1	0	0	1

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
33.8	0	1	1	0	0	1	0	1	0	0	1
33.9	0	1	1	0	0	1	0	1	0	1	1
34.0	0	1	1	0	0	1	0	1	0	1	0
34.1	0	1	1	0	0	1	0	1	1	1	0
34.2	0	1	1	0	0	1	0	1	1	0	0
34.3	0	1	1	0	0	1	0	0	1	0	0
34.4	0	1	1	0	0	1	0	0	1	1	0
34.5	0	1	1	0	0	1	0	0	0	1	0
34.6	0	1	1	0	0	1	0	0	0	1	1
34.7	0	1	1	0	0	1	0	0	0	0	1
34.8	0	1	1	0	1	1	0	0	0	0	1
34.9	0	1	1	0	1	1	0	0	0	1	1
35.0	0	1	1	0	1	1	0	0	0	1	0
35.1	0	1	1	0	1	1	0	0	1	1	0
35.2	0	1	1	0	1	1	0	0	1	0	0
35.3	0	1	1	0	1	1	0	1	1	0	0
35.4	0	1	1	0	1	1	0	1	1	1	0
35.5	0	1	1	0	1	1	0	1	0	1	0
35.6	0	1	1	0	1	1	0	1	0	1	1
35.7	0	1	1	0	1	1	0	1	0	0	1
35.8	0	1	1	0	1	1	1	1	0	0	1
35.9	0	1	1	0	1	1	1	1	0	1	1
36.0	0	1	1	0	1	1	1	1	0	1	0
36.1	0	1	1	0	1	1	1	1	1	1	0
36.2	0	1	1	0	1	1	1	1	1	0	0
36.3	0	1	1	0	1	1	1	0	1	0	0
36.4	0	1	1	0	1	1	1	0	1	1	0
36.5	0	1	1	0	1	1	1	0	0	1	0
36.6	0	1	1	0	1	1	1	0	0	1	1
36.7	0	1	1	0	1	1	1	0	0	0	1
36.8	0	1	1	0	1	0	1	0	0	0	1
36.9	0	1	1	0	1	0	1	0	0	1	1
37.0	0	1	1	0	1	0	1	0	0	1	0
37.1	0	1	1	0	1	0	1	0	1	1	0
37.2	0	1	1	0	1	0	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
37.3	0	1	1	0	1	0	1	1	1	0	0
37.4	0	1	1	0	1	0	1	1	1	1	0
37.5	0	1	1	0	1	0	1	1	0	1	0
37.6	0	1	1	0	1	0	1	1	0	1	1
37.7	0	1	1	0	1	0	1	1	0	0	1
37.8	0	1	1	0	1	0	0	1	0	0	1
37.9	0	1	1	0	1	0	0	1	0	1	1
38.0	0	1	1	0	1	0	0	1	0	1	0
38.1	0	1	1	0	1	0	0	1	1	1	0
38.2	0	1	1	0	1	0	0	1	1	0	0
38.3	0	1	1	0	1	0	0	0	1	0	0
38.4	0	1	1	0	1	0	0	0	1	1	0
38.5	0	1	1	0	1	0	0	0	0	1	0
38.6	0	1	1	0	1	0	0	0	0	1	1
38.7	0	1	1	0	1	0	0	0	0	0	1
38.9	0	1	1	1	1	0	0	0	0	0	1
39.0	0	1	1	1	1	0	0	0	0	1	1
39.1	0	1	1	1	1	0	0	0	0	1	0
39.2	0	1	1	1	1	0	0	0	1	1	0
39.3	0	1	1	1	1	0	0	0	1	0	0
39.4	0	1	1	1	1	0	0	1	1	0	0
39.5	0	1	1	1	1	0	0	1	1	1	0
39.5	0	1	1	1	1	0	0	1	0	1	0
39.6	0	1	1	1	1	0	0	1	0	1	1
39.7	0	1	1	1	1	0	0	1	0	0	1
39.8	0	1	1	1	1	0	1	1	0	0	1
39.9	0	1	1	1	1	0	1	1	0	1	1
40.0	0	1	1	1	1	0	1	1	0	1	0
40.1	0	1	1	1	1	0	1	1	1	1	0
40.2	0	1	1	1	1	0	1	1	1	0	0
40.3	0	1	1	1	1	0	1	0	1	0	0
40.4	0	1	1	1	1	0	1	0	1	1	0
40.5	0	1	1	1	1	0	1	0	0	1	0
40.6	0	1	1	1	1	0	1	0	0	1	1
40.7	0	1	1	1	1	0	1	0	0	0	1

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
40.8	0	1	1	1	1	1	1	0	0	0	1
40.9	0	1	1	1	1	1	1	0	0	1	1
41.0	0	1	1	1	1	1	1	0	0	1	0
41.1	0	1	1	1	1	1	1	0	1	1	0
41.2	0	1	1	1	1	1	1	0	1	0	0
41.3	0	1	1	1	1	1	1	1	1	0	0
41.4	0	1	1	1	1	1	1	1	1	1	0
41.5	0	1	1	1	1	1	1	1	0	1	0
41.6	0	1	1	1	1	1	1	1	0	1	1
41.7	0	1	1	1	1	1	1	1	0	0	1
41.8	0	1	1	1	1	1	0	1	0	0	1
41.9	0	1	1	1	1	1	0	1	0	1	1
42.0	0	1	1	1	1	1	0	1	0	1	0
42.1	0	1	1	1	1	1	0	1	1	1	0
42.2	0	1	1	1	1	1	0	1	1	0	0
42.3	0	1	1	1	1	1	0	0	1	0	0
42.4	0	1	1	1	1	1	0	0	1	1	0
42.5	0	1	1	1	1	1	0	0	0	1	0
42.6	0	1	1	1	1	1	0	0	0	1	1
42.7	0	1	1	1	1	1	0	0	0	0	1
42.8	0	1	1	1	0	1	0	0	0	0	1
42.9	0	1	1	1	0	1	0	0	0	1	1
43.0	0	1	1	1	0	1	0	0	0	1	0
43.1	0	1	1	1	0	1	0	0	1	1	0
43.2	0	1	1	1	0	1	0	0	1	0	0
43.3	0	1	1	1	0	1	0	1	1	0	0
43.4	0	1	1	1	0	1	0	1	1	1	0
43.5	0	1	1	1	0	1	0	1	0	1	0
43.6	0	1	1	1	0	1	0	1	0	1	1
43.7	0	1	1	1	0	1	0	1	0	0	1
43.8	0	1	1	1	0	1	1	1	0	0	1
43.9	0	1	1	1	0	1	1	1	0	1	1
44.0	0	1	1	1	0	1	1	1	0	1	0
44.1	0	1	1	1	0	1	1	1	1	1	0
44.2	0	1	1	1	0	1	1	1	1	0	0

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
44.3	0	1	1	1	0	1	1	0	1	0	0
44.4	0	1	1	1	0	1	1	0	1	1	0
44.5	0	1	1	1	0	1	1	0	0	1	0
44.6	0	1	1	1	0	1	1	0	0	1	1
44.7	0	1	1	1	0	1	1	0	0	0	1
44.8	0	1	1	1	0	0	1	0	0	0	1
44.9	0	1	1	1	0	0	1	0	0	1	1
45.0	0	1	1	1	0	0	1	0	0	1	0
45.1	0	1	1	1	0	0	1	0	1	1	0
45.2	0	1	1	1	0	0	1	0	1	0	0
45.3	0	1	1	1	0	0	1	1	1	0	0
45.4	0	1	1	1	0	0	1	1	1	1	0
45.5	0	1	1	1	0	0	1	1	0	1	0
45.6	0	1	1	1	0	0	1	1	0	1	1
45.7	0	1	1	1	0	0	1	1	0	0	1
45.8	0	1	1	1	0	0	0	1	0	0	1
45.9	0	1	1	1	0	0	0	1	0	1	1
46.0	0	1	1	1	0	0	0	1	0	1	0
46.1	0	1	1	1	0	0	0	1	1	1	0
46.2	0	1	1	1	0	0	0	1	1	0	0
46.3	0	1	1	1	0	0	0	0	1	0	0
46.4	0	1	1	1	0	0	0	0	1	1	0
46.5	0	1	1	1	0	0	0	0	0	1	0
46.6	0	1	1	1	0	0	0	0	0	1	1
46.7	0	1	1	1	0	0	0	0	0	0	1
46.8	0	1	0	1	0	0	0	0	0	0	1
46.9	0	1	0	1	0	0	0	0	0	1	1
47.0	0	1	0	1	0	0	0	0	0	1	0
47.1	0	1	0	1	0	0	0	0	1	1	0
47.2	0	1	0	1	0	0	0	0	1	0	0
47.3	0	1	0	1	0	0	0	1	1	0	0
47.4	0	1	0	1	0	0	0	1	1	1	0
47.5	0	1	0	1	0	0	0	1	0	1	0
47.6	0	1	0	1	0	0	0	1	0	1	1
47.7	0	1	0	1	0	0	0	1	0	0	1

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
47.8	0	1	0	1	0	0	1	1	0	0	1
47.9	0	1	0	1	0	0	1	1	0	1	1
48.0	0	1	0	1	0	0	1	1	0	1	0
48.1	0	1	0	1	0	0	1	1	1	1	0
48.2	0	1	0	1	0	0	1	1	1	0	0
48.3	0	1	0	1	0	0	1	0	1	0	0
48.4	0	1	0	1	0	0	1	0	1	1	0
48.5	0	1	0	1	0	0	1	0	0	1	0
48.6	0	1	0	1	0	0	1	0	0	1	1
48.7	0	1	0	1	0	0	1	0	0	0	1
48.8	0	1	0	1	0	1	1	0	0	0	1
48.9	0	1	0	1	0	1	1	0	0	1	1
49.0	0	1	0	1	0	1	1	0	0	1	0
49.1	0	1	0	1	0	1	1	0	1	1	0
49.2	0	1	0	1	0	1	1	0	1	0	0
49.3	0	1	0	1	0	1	1	1	1	0	0
49.4	0	1	0	1	0	1	1	1	1	1	0
49.5	0	1	0	1	0	1	1	1	0	1	0
49.6	0	1	0	1	0	1	1	1	0	1	1
49.7	0	1	0	1	0	1	1	1	0	0	1
49.8	0	1	0	1	0	1	0	1	0	0	1
49.9	0	1	0	1	0	1	0	1	0	1	1
50.0	0	1	0	1	0	1	0	1	0	1	0
50.1	0	1	0	1	0	1	0	1	1	1	0
50.2	0	1	0	1	0	1	0	1	1	0	0
50.3	0	1	0	1	0	1	0	0	1	0	0
50.4	0	1	0	1	0	1	0	0	1	1	0
50.5	0	1	0	1	0	1	0	0	0	1	0
50.6	0	1	0	1	0	1	0	0	0	1	1
50.7	0	1	0	1	0	1	0	0	0	0	1
50.8	0	1	0	1	1	1	0	0	0	0	1
50.9	0	1	0	1	1	1	0	0	0	1	1
51.0	0	1	0	1	1	1	0	0	0	1	0
51.1	0	1	0	1	1	1	0	0	1	1	0
51.2	0	1	0	1	1	1	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
51.3	0	1	0	1	1	1	0	1	1	0	0
51.4	0	1	0	1	1	1	0	1	1	1	0
51.5	0	1	0	1	1	1	0	1	0	1	0
51.6	0	1	0	1	1	1	0	1	0	1	1
51.7	0	1	0	1	1	1	0	1	0	0	1
51.8	0	1	0	1	1	1	1	1	0	0	1
51.9	0	1	0	1	1	1	1	1	0	1	1
52.0	0	1	0	1	1	1	1	1	0	1	0
52.1	0	1	0	1	1	1	1	1	1	1	0
52.2	0	1	0	1	1	1	1	1	1	0	0
52.3	0	1	0	1	1	1	1	0	1	0	0
52.4	0	1	0	1	1	1	1	0	1	1	0
52.5	0	1	0	1	1	1	1	0	0	1	0
52.6	0	1	0	1	1	1	1	0	0	1	1
52.7	0	1	0	1	1	1	1	0	0	0	1
52.8	0	1	0	1	1	0	1	0	0	0	1
52.9	0	1	0	1	1	0	1	0	0	1	1
53.0	0	1	0	1	1	0	1	0	0	1	0
53.1	0	1	0	1	1	0	1	0	1	1	0
53.2	0	1	0	1	1	0	1	0	1	0	0
53.3	0	1	0	1	1	0	1	1	1	0	0
53.4	0	1	0	1	1	0	1	1	1	1	0
53.5	0	1	0	1	1	0	1	1	0	1	0
53.6	0	1	0	1	1	0	1	1	0	1	1
53.7	0	1	0	1	1	0	1	1	0	0	1
53.8	0	1	0	1	1	0	0	1	0	0	1
53.9	0	1	0	1	1	0	0	1	0	1	1
54.0	0	1	0	1	1	0	0	1	0	1	0
54.1	0	1	0	1	1	0	0	1	1	1	0
54.2	0	1	0	1	1	0	0	1	1	0	0
54.3	0	1	0	1	1	0	0	0	1	0	0
54.4	0	1	0	1	1	0	0	0	1	1	0
54.5	0	1	0	1	1	0	0	0	0	1	0
54.6	0	1	0	1	1	0	0	0	0	1	1
54.7	0	1	0	1	1	0	0	0	0	0	1

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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
54.8	0	1	0	0	1	0	0	0	0	0	1
54.9	0	1	0	0	1	0	0	0	0	1	1
55.0	0	1	0	0	1	0	0	0	0	1	0
55.1	0	1	0	0	1	0	0	0	1	1	0
55.2	0	1	0	0	1	0	0	0	1	0	0
55.3	0	1	0	0	1	0	0	1	1	0	0
55.4	0	1	0	0	1	0	0	1	1	1	0
55.5	0	1	0	0	1	0	0	1	0	1	0
55.6	0	1	0	0	1	0	0	1	0	1	1
55.7	0	1	0	0	1	0	0	1	0	0	1
55.8	0	1	0	0	1	0	1	1	0	0	1
55.9	0	1	0	0	1	0	1	1	0	1	1
56.0	0	1	0	0	1	0	1	1	0	1	0
56.1	0	1	0	0	1	0	1	1	1	1	0
56.2	0	1	0	0	1	0	1	1	1	0	0
56.3	0	1	0	0	1	0	1	0	1	0	0
56.4	0	1	0	0	1	0	1	0	1	1	0
56.5	0	1	0	0	1	0	1	0	0	1	0
56.6	0	1	0	0	1	0	1	0	0	1	1
56.7	0	1	0	0	1	0	1	0	0	0	1
56.8	0	1	0	0	1	1	1	0	0	0	1
56.9	0	1	0	0	1	1	1	0	0	1	1
57.0	0	1	0	0	1	1	1	0	0	1	0
57.1	0	1	0	0	1	1	1	0	1	1	0
57.2	0	1	0	0	1	1	1	0	1	0	0
57.3	0	1	0	0	1	1	1	1	1	0	0
57.4	0	1	0	0	1	1	1	1	1	1	0
57.5	0	1	0	0	1	1	1	1	0	1	0
57.6	0	1	0	0	1	1	1	1	0	1	1
57.7	0	1	0	0	1	1	1	1	0	0	1
57.8	0	1	0	0	1	1	0	1	0	0	1
57.9	0	1	0	0	1	1	0	1	0	1	1
58.0	0	1	0	0	1	1	0	1	0	1	0
58.1	0	1	0	0	1	1	0	1	1	1	0
58.2	0	1	0	0	1	1	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
58.3	0	1	0	0	1	1	0	0	1	0	0
58.4	0	1	0	0	1	1	0	0	1	1	0
58.5	0	1	0	0	1	1	0	0	0	1	0
58.6	0	1	0	0	1	1	0	0	0	1	1
58.7	0	1	0	0	1	1	0	0	0	0	1
58.8	0	1	0	0	0	1	0	0	0	0	1
58.9	0	1	0	0	0	1	0	0	0	1	1
59.0	0	1	0	0	0	1	0	0	0	1	0
59.1	0	1	0	0	0	1	0	0	1	1	0
59.2	0	1	0	0	0	1	0	0	1	0	0
59.3	0	1	0	0	0	1	0	1	1	0	0
59.4	0	1	0	0	0	1	0	1	1	1	0
59.5	0	1	0	0	0	1	0	1	0	1	0
59.6	0	1	0	0	0	1	0	1	0	1	1
59.7	0	1	0	0	0	1	0	1	0	0	1
59.8	0	1	0	0	0	1	1	1	0	0	1
59.9	0	1	0	0	0	1	1	1	0	1	1
60.0	0	1	0	0	0	1	1	1	0	1	0
60.1	0	1	0	0	0	1	1	1	1	1	0
60.2	0	1	0	0	0	1	1	1	1	0	0
60.3	0	1	0	0	0	1	1	0	1	0	0
60.4	0	1	0	0	0	1	1	0	1	1	0
60.5	0	1	0	0	0	1	1	0	0	1	0
60.6	0	1	0	0	0	1	1	0	0	1	1
60.7	0	1	0	0	0	1	1	0	0	0	1
60.8	0	1	0	0	0	0	1	0	0	0	1
60.9	0	1	0	0	0	0	1	0	0	1	1
61.0	0	1	0	0	0	0	1	0	0	1	0
61.1	0	1	0	0	0	0	1	0	1	1	0
61.2	0	1	0	0	0	0	1	0	1	0	0
61.3	0	1	0	0	0	0	1	1	1	0	0
61.4	0	1	0	0	0	0	1	1	1	1	0
61.5	0	1	0	0	0	0	1	1	0	1	0
61.6	0	1	0	0	0	0	1	1	0	1	1
61.7	0	1	0	0	0	0	1	1	0	0	1

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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
61.8	0	1	0	0	0	0	0	1	0	0	1
61.9	0	1	0	0	0	0	0	1	0	1	1
62.0	0	1	0	0	0	0	0	1	0	1	0
62.1	0	1	0	0	0	0	0	1	1	1	0
62.2	0	1	0	0	0	0	0	1	1	0	0
62.3	0	1	0	0	0	0	0	0	1	0	0
62.4	0	1	0	0	0	0	0	0	1	1	0
62.5	0	1	0	0	0	0	0	0	0	1	0
62.6	0	1	0	0	0	0	0	0	0	1	1
62.7	0	1	0	0	0	0	0	0	0	0	1
62.8	1	1	0	0	0	0	0	0	0	0	1
62.9	1	1	0	0	0	0	0	0	0	1	1
63.0	1	1	0	0	0	0	0	0	0	1	0
63.1	1	1	0	0	0	0	0	0	1	1	0
63.2	1	1	0	0	0	0	0	0	1	0	0
63.3	1	1	0	0	0	0	0	1	1	0	0
63.4	1	1	0	0	0	0	0	1	1	1	0
63.5	1	1	0	0	0	0	0	1	0	1	0
63.6	1	1	0	0	0	0	0	1	0	1	1
63.7	1	1	0	0	0	0	0	1	0	0	1
63.8	1	1	0	0	0	0	1	1	0	0	1
63.9	1	1	0	0	0	0	1	1	0	1	1
64.0	1	1	0	0	0	0	1	1	0	1	0
64.1	1	1	0	0	0	0	1	1	1	1	0
64.2	1	1	0	0	0	0	1	1	1	0	0
64.3	1	1	0	0	0	0	1	0	1	0	0
64.4	1	1	0	0	0	0	1	0	1	1	0
64.5	1	1	0	0	0	0	1	0	0	1	0
64.6	1	1	0	0	0	0	1	0	0	1	1
64.7	1	1	0	0	0	0	1	0	0	0	1
64.8	1	1	0	0	0	1	1	0	0	0	1
64.9	1	1	0	0	0	1	1	0	0	1	1
65.0	1	1	0	0	0	1	1	0	0	1	0
65.1	1	1	0	0	0	1	1	0	1	1	0
65.2	1	1	0	0	0	1	1	0	1	0	0

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
(Sheet 20 of 37)

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
65.3	1	1	0	0	0	1	1	1	1	0	0
65.4	1	1	0	0	0	1	1	1	1	1	0
65.5	1	1	0	0	0	1	1	1	0	1	0
65.6	1	1	0	0	0	1	1	1	0	1	1
65.7	1	1	0	0	0	1	1	1	0	0	1
65.8	1	1	0	0	0	1	0	1	0	0	1
65.9	1	1	0	0	0	1	0	1	0	1	1
66.0	1	1	0	0	0	1	0	1	0	1	0
66.1	1	1	0	0	0	1	0	1	1	1	0
66.2	1	1	0	0	0	1	0	1	1	0	0
66.3	1	1	0	0	0	1	0	0	1	0	0
66.4	1	1	0	0	0	1	0	0	1	1	0
66.5	1	1	0	0	0	1	0	0	0	1	0
66.6	1	1	0	0	0	1	0	0	0	1	1
66.7	1	1	0	0	0	1	0	0	0	0	1
66.8	1	1	0	0	1	1	0	0	0	0	1
66.9	1	1	0	0	1	1	0	0	0	1	1
67.0	1	1	0	0	1	1	0	0	0	1	0
67.1	1	1	0	0	1	1	0	0	1	1	0
67.2	1	1	0	0	1	1	0	0	1	0	0
67.3	1	1	0	0	1	1	0	1	1	0	0
67.4	1	1	0	0	1	1	0	1	1	1	0
67.5	1	1	0	0	1	1	0	1	0	1	0
67.6	1	1	0	0	1	1	0	1	0	1	1
67.7	1	1	0	0	1	1	0	1	0	0	1
67.8	1	1	0	0	1	1	1	1	0	0	1
67.9	1	1	0	0	1	1	1	1	0	1	1
68.0	1	1	0	0	1	1	1	1	0	1	0
68.1	1	1	0	0	1	1	1	1	1	1	0
68.2	1	1	0	0	1	1	1	1	1	0	0
68.3	1	1	0	0	1	1	1	0	1	0	0
68.4	1	1	0	0	1	1	1	0	1	1	0
68.5	1	1	0	0	1	1	1	0	0	1	0
68.6	1	1	0	0	1	1	1	0	0	1	1
68.7	1	1	0	0	1	1	1	0	0	0	1

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
(Sheet 21 of 37)

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
68.8	1	1	0	0	1	0	1	0	0	0	1
68.9	1	1	0	0	1	0	1	0	0	1	1
69.0	1	1	0	0	1	0	1	0	0	1	0
69.1	1	1	0	0	1	0	1	0	1	1	0
69.2	1	1	0	0	1	0	1	0	1	0	0
69.3	1	1	0	0	1	0	1	1	1	0	0
69.4	1	1	0	0	1	0	1	1	1	1	0
69.5	1	1	0	0	1	0	1	1	0	1	0
69.6	1	1	0	0	1	0	1	1	0	1	1
69.7	1	1	0	0	1	0	1	1	0	0	1
69.8	1	1	0	0	1	0	0	1	0	0	1
69.9	1	1	0	0	1	0	0	1	0	1	1
70.0	1	1	0	0	1	0	0	1	0	1	0
70.1	1	1	0	0	1	0	0	1	1	1	0
70.2	1	1	0	0	1	0	0	1	1	0	0
70.3	1	1	0	0	1	0	0	0	1	0	0
70.4	1	1	0	0	1	0	0	0	1	1	0
70.5	1	1	0	0	1	0	0	0	0	1	0
70.6	1	1	0	0	1	0	0	0	0	1	1
70.7	1	1	0	0	1	0	0	0	0	0	1
70.8	1	1	0	1	1	0	0	0	0	0	1
70.9	1	1	0	1	1	0	0	0	0	1	1
71.0	1	1	0	1	1	0	0	0	0	1	0
71.1	1	1	0	1	1	0	0	0	1	1	0
71.2	1	1	0	1	1	0	0	0	1	0	0
71.3	1	1	0	1	1	0	0	1	1	0	0
71.4	1	1	0	1	1	0	0	1	1	1	0
71.5	1	1	0	1	1	0	0	1	0	1	0
71.6	1	1	0	1	1	0	0	1	0	1	1
71.7	1	1	0	1	1	0	0	1	0	0	1
71.8	1	1	0	1	1	0	1	1	0	0	1
71.9	1	1	0	1	1	0	1	1	0	1	1
72.0	1	1	0	1	1	0	1	1	0	1	0
72.1	1	1	0	1	1	0	1	1	1	1	0
72.2	1	1	0	1	1	0	1	1	1	0	0

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
72.3	1	1	0	1	1	0	1	0	1	0	0
72.4	1	1	0	1	1	0	1	0	1	1	0
72.5	1	1	0	1	1	0	1	0	0	1	0
72.6	1	1	0	1	1	0	1	0	0	1	1
72.7	1	1	0	1	1	0	1	0	0	0	1
72.8	1	1	0	1	1	1	1	0	0	0	1
72.9	1	1	0	1	1	1	1	0	0	1	1
73.0	1	1	0	1	1	1	1	0	0	1	0
73.1	1	1	0	1	1	1	1	0	1	1	0
73.2	1	1	0	1	1	1	1	0	1	0	0
73.3	1	1	0	1	1	1	1	1	1	0	0
73.4	1	1	0	1	1	1	1	1	1	1	0
73.5	1	1	0	1	1	1	1	1	0	1	0
73.6	1	1	0	1	1	1	1	1	0	1	1
73.7	1	1	0	1	1	1	1	1	0	0	1
73.8	1	1	0	1	1	1	0	1	0	0	1
73.9	1	1	0	1	1	1	0	1	0	1	1
74.0	1	1	0	1	1	1	0	1	0	1	0
74.1	1	1	0	1	1	1	0	1	1	1	0
74.2	1	1	0	1	1	1	0	1	1	0	0
74.3	1	1	0	1	1	1	0	0	1	0	0
74.4	1	1	0	1	1	1	0	0	1	1	0
74.5	1	1	0	1	1	1	0	0	0	1	0
74.6	1	1	0	1	1	1	0	0	0	1	1
74.7	1	1	0	1	1	1	0	0	0	0	1
74.8	1	1	0	1	0	1	0	0	0	0	1
74.9	1	1	0	1	0	1	0	0	0	1	1
75.0	1	1	0	1	0	1	0	0	0	1	0
75.1	1	1	0	1	0	1	0	0	1	1	0
75.2	1	1	0	1	0	1	0	0	1	0	0
75.3	1	1	0	1	0	1	0	1	1	0	0
75.4	1	1	0	1	0	1	0	1	1	1	0
75.5	1	1	0	1	0	1	0	1	0	1	0
75.6	1	1	0	1	0	1	0	1	0	1	1
75.7	1	1	0	1	0	1	0	1	0	0	1

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
75.8	1	1	0	1	0	1	1	1	0	0	1
75.9	1	1	0	1	0	1	1	1	0	1	1
76.0	1	1	0	1	0	1	1	1	0	1	0
76.1	1	1	0	1	0	1	1	1	1	1	0
76.2	1	1	0	1	0	1	1	1	1	0	0
76.3	1	1	0	1	0	1	1	0	1	0	0
76.4	1	1	0	1	0	1	1	0	1	1	0
76.5	1	1	0	1	0	1	1	0	0	1	0
76.6	1	1	0	1	0	1	1	0	0	1	1
76.7	1	1	0	1	0	1	1	0	0	0	1
76.8	1	1	0	1	0	0	1	0	0	0	1
76.9	1	1	0	1	0	0	1	0	0	1	1
77.0	1	1	0	1	0	0	1	0	0	1	0
77.1	1	1	0	1	0	0	1	0	1	1	0
77.2	1	1	0	1	0	0	1	0	1	0	0
77.3	1	1	0	1	0	0	1	1	1	0	0
77.4	1	1	0	1	0	0	1	1	1	1	0
77.5	1	1	0	1	0	0	1	1	0	1	0
77.6	1	1	0	1	0	0	1	1	0	1	1
77.7	1	1	0	1	0	0	1	1	0	0	1
77.8	1	1	0	1	0	0	0	1	0	0	1
77.9	1	1	0	1	0	0	0	1	0	1	1
78.0	1	1	0	1	0	0	0	1	0	1	0
78.1	1	1	0	1	0	0	0	1	1	1	0
78.2	1	1	0	1	0	0	0	1	1	0	0
78.3	1	1	0	1	0	0	0	0	1	0	0
78.4	1	1	0	1	0	0	0	0	1	1	0
78.5	1	1	0	1	0	0	0	0	0	1	0
78.6	1	1	0	1	0	0	0	0	0	1	1
78.7	1	1	0	1	0	0	0	0	0	0	1
78.8	1	1	1	1	0	0	0	0	0	0	1
78.9	1	1	1	1	0	0	0	0	0	1	1
79.0	1	1	1	1	0	0	0	0	0	1	0
79.1	1	1	1	1	0	0	0	0	1	1	0
79.2	1	1	1	1	0	0	0	0	1	0	0

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
79.3	1	1	1	1	0	0	0	1	1	0	0
79.4	1	1	1	1	0	0	0	1	1	1	0
79.5	1	1	1	1	0	0	0	1	0	1	0
79.6	1	1	1	1	0	0	0	1	0	1	1
79.7	1	1	1	1	0	0	0	1	0	0	1
79.8	1	1	1	1	0	0	1	1	0	0	1
79.9	1	1	1	1	0	0	1	1	0	1	1
80.0	1	1	1	1	0	0	1	1	0	1	0
80.1	1	1	1	1	0	0	1	1	1	1	0
80.2	1	1	1	1	0	0	1	1	1	0	0
80.3	1	1	1	1	0	0	1	0	1	0	0
80.4	1	1	1	1	0	0	1	0	1	1	0
80.5	1	1	1	1	0	0	1	0	0	1	0
80.6	1	1	1	1	0	0	1	0	0	1	1
80.7	1	1	1	1	0	0	1	0	0	0	1
80.8	1	1	1	1	0	1	1	0	0	0	1
80.9	1	1	1	1	0	1	1	0	0	1	1
81.0	1	1	1	1	0	1	1	0	0	1	0
81.1	1	1	1	1	0	1	1	0	1	1	0
81.2	1	1	1	1	0	1	1	0	1	0	0
81.3	1	1	1	1	0	1	1	1	1	0	0
81.4	1	1	1	1	0	1	1	1	1	1	0
81.5	1	1	1	1	0	1	1	1	0	1	0
81.6	1	1	1	1	0	1	1	1	0	1	1
81.7	1	1	1	1	0	1	1	1	0	0	1
81.8	1	1	1	1	0	1	0	1	0	0	1
81.9	1	1	1	1	0	1	0	1	0	1	1
82.0	1	1	1	1	0	1	0	1	0	1	0
82.1	1	1	1	1	0	1	0	1	1	1	0
82.2	1	1	1	1	0	1	0	1	1	0	0
82.3	1	1	1	1	0	1	0	0	1	0	0
82.4	1	1	1	1	0	1	0	0	1	1	0
82.5	1	1	1	1	0	1	0	0	0	1	0
82.6	1	1	1	1	0	1	0	0	0	1	1
82.7	1	1	1	1	0	1	0	0	0	0	1

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
82.8	1	1	1	1	1	1	0	0	0	0	1
82.9	1	1	1	1	1	1	0	0	0	1	1
83.0	1	1	1	1	1	1	0	0	0	1	0
83.1	1	1	1	1	1	1	0	0	1	1	0
83.2	1	1	1	1	1	1	0	0	1	0	0
83.3	1	1	1	1	1	1	0	1	1	0	0
83.4	1	1	1	1	1	1	0	1	1	1	0
83.5	1	1	1	1	1	1	0	1	0	1	0
83.6	1	1	1	1	1	1	0	1	0	1	1
83.7	1	1	1	1	1	1	0	1	0	0	1
83.8	1	1	1	1	1	1	1	1	0	0	1
83.9	1	1	1	1	1	1	1	1	0	1	1
84.0	1	1	1	1	1	1	1	1	0	1	0
84.1	1	1	1	1	1	1	1	1	1	1	0
84.2	1	1	1	1	1	1	1	1	1	0	0
84.3	1	1	1	1	1	1	1	0	1	0	0
84.4	1	1	1	1	1	1	1	0	1	1	0
84.5	1	1	1	1	1	1	1	0	0	1	0
84.6	1	1	1	1	1	1	1	0	0	1	1
84.7	1	1	1	1	1	1	1	0	0	0	1
84.8	1	1	1	1	1	0	1	0	0	0	1
84.9	1	1	1	1	1	0	1	0	0	1	1
85.0	1	1	1	1	1	0	1	0	0	1	0
85.1	1	1	1	1	1	0	1	0	1	1	0
85.2	1	1	1	1	1	0	1	0	1	0	0
85.3	1	1	1	1	1	0	1	1	1	0	0
85.4	1	1	1	1	1	0	1	1	1	1	0
85.5	1	1	1	1	1	0	1	1	0	1	0
85.6	1	1	1	1	1	0	1	1	0	1	1
85.7	1	1	1	1	1	0	1	1	0	0	1
85.8	1	1	1	1	1	0	0	1	0	0	1
85.9	1	1	1	1	1	0	0	1	0	1	1
86.0	1	1	1	1	1	0	0	1	0	1	0
86.1	1	1	1	1	1	0	0	1	1	1	0
86.2	1	1	1	1	1	0	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
86.3	1	1	1	1	1	0	0	0	1	0	0
86.4	1	1	1	1	1	0	0	0	1	1	0
86.5	1	1	1	1	1	0	0	0	0	1	0
86.6	1	1	1	1	1	0	0	0	0	1	1
86.7	1	1	1	1	1	0	0	0	0	0	1
86.8	1	1	1	0	1	0	0	0	0	0	1
86.9	1	1	1	0	1	0	0	0	0	1	1
87.0	1	1	1	0	1	0	0	0	0	1	0
87.1	1	1	1	0	1	0	0	0	1	1	0
87.2	1	1	1	0	1	0	0	0	1	0	0
87.3	1	1	1	0	1	0	0	1	1	0	0
87.4	1	1	1	0	1	0	0	1	1	1	0
87.5	1	1	1	0	1	0	0	1	0	1	0
87.6	1	1	1	0	1	0	0	1	0	1	1
87.7	1	1	1	0	1	0	0	1	0	0	1
87.8	1	1	1	0	1	0	1	1	0	0	1
87.9	1	1	1	0	1	0	1	1	0	1	1
88.0	1	1	1	0	1	0	1	1	0	1	0
88.1	1	1	1	0	1	0	1	1	1	1	0
88.2	1	1	1	0	1	0	1	1	1	0	0
88.3	1	1	1	0	1	0	1	0	1	0	0
88.4	1	1	1	0	1	0	1	0	1	1	0
88.5	1	1	1	0	1	0	1	0	0	1	0
88.6	1	1	1	0	1	0	1	0	0	1	1
88.7	1	1	1	0	1	0	1	0	0	0	1
88.8	1	1	1	0	1	1	1	0	0	0	1
88.9	1	1	1	0	1	1	1	0	0	1	1
89.0	1	1	1	0	1	1	1	0	0	1	0
89.1	1	1	1	0	1	1	1	0	1	1	0
89.2	1	1	1	0	1	1	1	0	1	0	0
89.3	1	1	1	0	1	1	1	1	1	0	0
89.4	1	1	1	0	1	1	1	1	1	1	0
89.5	1	1	1	0	1	1	1	1	0	1	0
89.6	1	1	1	0	1	1	1	1	0	1	1
89.7	1	1	1	0	1	1	1	1	0	0	1

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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
89.8	1	1	1	0	1	1	0	1	0	0	1
89.9	1	1	1	0	1	1	0	1	0	1	1
90.0	1	1	1	0	1	1	0	1	0	1	0
90.1	1	1	1	0	1	1	0	1	1	1	0
90.2	1	1	1	0	1	1	0	1	1	0	0
90.3	1	1	1	0	1	1	0	0	1	0	0
90.4	1	1	1	0	1	1	0	0	1	1	0
90.5	1	1	1	0	1	1	0	0	0	1	0
90.6	1	1	1	0	1	1	0	0	0	1	1
90.7	1	1	1	0	1	1	0	0	0	0	1
90.8	1	1	1	0	0	1	0	0	0	0	1
90.9	1	1	1	0	0	1	0	0	0	1	1
91.0	1	1	1	0	0	1	0	0	0	1	0
91.1	1	1	1	0	0	1	0	0	1	1	0
91.2	1	1	1	0	0	1	0	0	1	0	0
91.3	1	1	1	0	0	1	0	1	1	0	0
91.4	1	1	1	0	0	1	0	1	1	1	0
91.5	1	1	1	0	0	1	0	1	0	1	0
91.6	1	1	1	0	0	1	0	1	0	1	1
91.7	1	1	1	0	0	1	0	1	0	0	1
91.8	1	1	1	0	0	1	1	1	0	0	1
91.9	1	1	1	0	0	1	1	1	0	1	1
92.0	1	1	1	0	0	1	1	1	0	1	0
92.1	1	1	1	0	0	1	1	1	1	1	0
92.2	1	1	1	0	0	1	1	1	1	0	0
92.3	1	1	1	0	0	1	1	0	1	0	0
92.4	1	1	1	0	0	1	1	0	1	1	0
92.5	1	1	1	0	0	1	1	0	0	1	0
92.6	1	1	1	0	0	1	1	0	0	1	1
92.7	1	1	1	0	0	1	1	0	0	0	1
92.8	1	1	1	0	0	0	1	0	0	0	1
92.9	1	1	1	0	0	0	1	0	0	1	1
93.0	1	1	1	0	0	0	1	0	0	1	0
93.1	1	1	1	0	0	0	1	0	1	1	0
93.2	1	1	1	0	0	0	1	0	1	0	0

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
93.3	1	1	1	0	0	0	1	1	1	0	0
93.4	1	1	1	0	0	0	1	1	1	1	0
93.5	1	1	1	0	0	0	1	1	0	1	0
93.6	1	1	1	0	0	0	1	1	0	1	1
93.7	1	1	1	0	0	0	1	1	0	0	1
93.8	1	1	1	0	0	0	0	1	0	0	1
93.9	1	1	1	0	0	0	0	1	0	1	1
94.0	1	1	1	0	0	0	0	1	0	1	0
94.1	1	1	1	0	0	0	0	1	1	1	0
94.2	1	1	1	0	0	0	0	1	1	0	0
94.3	1	1	1	0	0	0	0	0	1	0	0
94.4	1	1	1	0	0	0	0	0	1	1	0
94.5	1	1	1	0	0	0	0	0	0	1	0
94.6	1	1	1	0	0	0	0	0	0	1	1
94.7	1	1	1	0	0	0	0	0	0	0	1
94.8	1	0	1	0	0	0	0	0	0	0	1
94.9	1	0	1	0	0	0	0	0	0	1	1
95.0	1	0	1	0	0	0	0	0	0	1	0
95.1	1	0	1	0	0	0	0	0	1	1	0
95.2	1	0	1	0	0	0	0	0	1	0	0
95.3	1	0	1	0	0	0	0	1	1	0	0
95.4	1	0	1	0	0	0	0	1	1	1	0
95.5	1	0	1	0	0	0	0	1	0	1	0
95.6	1	0	1	0	0	0	0	1	0	1	1
95.7	1	0	1	0	0	0	0	1	0	0	1
95.8	1	0	1	0	0	0	1	1	0	0	1
95.9	1	0	1	0	0	0	1	1	0	1	1
96.0	1	0	1	0	0	0	1	1	0	1	0
96.1	1	0	1	0	0	0	1	1	1	1	0
96.2	1	0	1	0	0	0	1	1	1	0	0
96.3	1	0	1	0	0	0	1	0	1	0	0
96.4	1	0	1	0	0	0	1	0	1	1	0
96.5	1	0	1	0	0	0	1	0	0	1	0
96.6	1	0	1	0	0	0	1	0	0	1	1
96.7	1	0	1	0	0	0	1	0	0	0	1

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
(Sheet 29 of 37)

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
96.8	1	0	1	0	0	1	1	0	0	0	1
96.9	1	0	1	0	0	1	1	0	0	1	1
97.0	1	0	1	0	0	1	1	0	0	1	0
97.1	1	0	1	0	0	1	1	0	1	1	0
97.2	1	0	1	0	0	1	1	0	1	0	0
97.3	1	0	1	0	0	1	1	1	1	0	0
97.4	1	0	1	0	0	1	1	1	1	1	0
97.5	1	0	1	0	0	1	1	1	0	1	0
97.6	1	0	1	0	0	1	1	1	0	1	1
97.7	1	0	1	0	0	1	1	1	0	0	1
97.8	1	0	1	0	0	1	0	1	0	0	1
97.9	1	0	1	0	0	1	0	1	0	1	1
98.0	1	0	1	0	0	1	0	1	0	1	0
98.1	1	0	1	0	0	1	0	1	1	1	0
98.2	1	0	1	0	0	1	0	1	1	0	0
98.3	1	0	1	0	0	1	0	0	1	0	0
98.4	1	0	1	0	0	1	0	0	1	1	0
98.5	1	0	1	0	0	1	0	0	0	1	0
98.6	1	0	1	0	0	1	0	0	0	1	1
98.7	1	0	1	0	0	1	0	0	0	0	1
98.8	1	0	1	0	1	1	0	0	0	0	1
98.9	1	0	1	0	1	1	0	0	0	1	1
99.0	1	0	1	0	1	1	0	0	0	1	0
99.1	1	0	1	0	1	1	0	0	1	1	0
99.2	1	0	1	0	1	1	0	0	1	0	0
99.3	1	0	1	0	1	1	0	1	1	0	0
99.4	1	0	1	0	1	1	0	1	1	1	0
99.5	1	0	1	0	1	1	0	1	0	1	0
99.6	1	0	1	0	1	1	0	1	0	1	1
99.7	1	0	1	0	1	1	0	1	0	0	1
99.8	1	0	1	0	1	1	1	1	0	0	1
99.9	1	0	1	0	1	1	1	1	0	1	1
100.0	1	0	1	0	1	1	1	1	0	1	0
100.1	1	0	1	0	1	1	1	1	1	1	0
100.2	1	0	1	0	1	1	1	1	1	0	0

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
100.3	1	0	1	0	1	1	1	0	1	0	0
100.4	1	0	1	0	1	1	1	0	1	1	0
100.5	1	0	1	0	1	1	1	0	0	1	0
100.6	1	0	1	0	1	1	1	0	0	1	1
100.7	1	0	1	0	1	1	1	0	0	0	1
100.8	1	0	1	0	1	0	1	0	0	0	1
100.9	1	0	1	0	1	0	1	0	0	1	1
101.0	1	0	1	0	1	0	1	0	0	1	0
101.1	1	0	1	0	1	0	1	0	1	1	0
101.2	1	0	1	0	1	0	1	0	1	0	0
101.3	1	0	1	0	1	0	1	1	1	0	0
101.4	1	0	1	0	1	0	1	1	1	1	0
101.5	1	0	1	0	1	0	1	1	0	1	0
101.6	1	0	1	0	1	0	1	1	0	1	1
101.7	1	0	1	0	1	0	1	1	0	0	1
101.8	1	0	1	0	1	0	0	1	0	0	1
101.9	1	0	1	0	1	0	0	1	0	1	1
102.0	1	0	1	0	1	0	0	1	0	1	0
102.1	1	0	1	0	1	0	0	1	1	1	0
102.2	1	0	1	0	1	0	0	1	1	0	0
102.3	1	0	1	0	1	0	0	0	1	0	0
102.4	1	0	1	0	1	0	0	0	1	1	0
102.5	1	0	1	0	1	0	0	0	0	1	0
102.6	1	0	1	0	1	0	0	0	0	1	1
102.7	1	0	1	0	1	0	0	0	0	0	1
102.8	1	0	1	1	1	0	0	0	0	0	1
102.9	1	0	1	1	1	0	0	0	0	1	1
103.0	1	0	1	1	1	0	0	0	0	1	0
103.1	1	0	1	1	1	0	0	0	1	1	0
103.2	1	0	1	1	1	0	0	0	1	0	0
103.3	1	0	1	1	1	0	0	1	1	0	0
103.4	1	0	1	1	1	0	0	1	1	1	0
103.5	1	0	1	1	1	0	0	1	0	1	0
103.6	1	0	1	1	1	0	0	1	0	1	1
103.7	1	0	1	1	1	0	0	1	0	0	1

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
103.8	1	0	1	1	1	0	1	1	0	0	1
103.9	1	0	1	1	1	0	1	1	0	1	1
104.0	1	0	1	1	1	0	1	1	0	1	0
104.1	1	0	1	1	1	0	1	1	1	1	0
104.2	1	0	1	1	1	0	1	1	1	0	0
104.3	1	0	1	1	1	0	1	0	1	0	0
104.4	1	0	1	1	1	0	1	0	1	1	0
104.5	1	0	1	1	1	0	1	0	0	1	0
104.6	1	0	1	1	1	0	1	0	0	1	1
104.7	1	0	1	1	1	0	1	0	0	0	1
104.8	1	0	1	1	1	1	1	0	0	0	1
104.9	1	0	1	1	1	1	1	0	0	1	1
105.0	1	0	1	1	1	1	1	0	0	1	0
105.1	1	0	1	1	1	1	1	0	1	1	0
105.2	1	0	1	1	1	1	1	0	1	0	0
105.3	1	0	1	1	1	1	1	1	1	0	0
105.4	1	0	1	1	1	1	1	1	1	1	0
105.5	1	0	1	1	1	1	1	1	0	1	0
105.6	1	0	1	1	1	1	1	1	0	1	1
105.7	1	0	1	1	1	1	1	1	0	0	1
105.8	1	0	1	1	1	1	0	1	0	0	1
105.9	1	0	1	1	1	1	0	1	0	1	1
106.0	1	0	1	1	1	1	0	1	0	1	0
106.1	1	0	1	1	1	1	0	1	1	1	0
106.2	1	0	1	1	1	1	0	1	1	0	0
106.3	1	0	1	1	1	1	0	0	1	0	0
106.4	1	0	1	1	1	1	0	0	1	1	0
106.5	1	0	1	1	1	1	0	0	0	1	0
106.6	1	0	1	1	1	1	0	0	0	1	1
106.7	1	0	1	1	1	1	0	0	0	0	1
106.8	1	0	1	1	0	1	0	0	0	0	1
106.9	1	0	1	1	0	1	0	0	0	1	1
107.0	1	0	1	1	0	1	0	0	0	1	0
107.1	1	0	1	1	0	1	0	0	1	1	0
107.2	1	0	1	1	0	1	0	0	1	0	0

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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
107.3	1	0	1	1	0	1	0	1	1	0	0
107.4	1	0	1	1	0	1	0	1	1	1	0
107.5	1	0	1	1	0	1	0	1	0	1	0
107.6	1	0	1	1	0	1	0	1	0	1	1
107.7	1	0	1	1	0	1	0	1	0	0	1
107.8	1	0	1	1	0	1	1	1	0	0	1
107.9	1	0	1	1	0	1	1	1	0	1	1
108.0	1	0	1	1	0	1	1	1	0	1	0
108.1	1	0	1	1	0	1	1	1	1	1	0
108.2	1	0	1	1	0	1	1	1	1	0	0
108.3	1	0	1	1	0	1	1	0	1	0	0
108.4	1	0	1	1	0	1	1	0	1	1	0
108.5	1	0	1	1	0	1	1	0	0	1	0
108.6	1	0	1	1	0	1	1	0	0	1	1
108.7	1	0	1	1	0	1	1	0	0	0	1
108.8	1	0	1	1	0	0	1	0	0	0	1
108.9	1	0	1	1	0	0	1	0	0	1	1
109.0	1	0	1	1	0	0	1	0	0	1	0
109.1	1	0	1	1	0	0	1	0	1	1	0
109.2	1	0	1	1	0	0	1	0	1	0	0
109.3	1	0	1	1	0	0	1	1	1	0	0
109.4	1	0	1	1	0	0	1	1	1	1	0
109.5	1	0	1	1	0	0	1	1	0	1	0
109.6	1	0	1	1	0	0	1	1	0	1	1
109.7	1	0	1	1	0	0	1	1	0	0	1
109.8	1	0	1	1	0	0	0	1	0	0	1
109.9	1	0	1	1	0	0	0	1	0	1	1
110.0	1	0	1	1	0	0	0	1	0	1	0
110.1	1	0	1	1	0	0	0	1	1	1	0
110.2	1	0	1	1	0	0	0	1	1	0	0
110.3	1	0	1	1	0	0	0	0	1	0	0
110.4	1	0	1	1	0	0	0	0	1	1	0
110.5	1	0	1	1	0	0	0	0	0	1	0
110.6	1	0	1	1	0	0	0	0	0	1	1
110.7	1	0	1	1	0	0	0	0	0	0	1

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
110.8	1	0	0	1	0	0	0	0	0	0	1
110.9	1	0	0	1	0	0	0	0	0	1	1
111.0	1	0	0	1	0	0	0	0	0	1	0
111.1	1	0	0	1	0	0	0	0	1	1	0
111.2	1	0	0	1	0	0	0	0	1	0	0
111.3	1	0	0	1	0	0	0	1	1	0	0
111.4	1	0	0	1	0	0	0	1	1	1	0
111.5	1	0	0	1	0	0	0	1	0	1	0
111.6	1	0	0	1	0	0	0	1	0	1	1
111.7	1	0	0	1	0	0	0	1	0	0	1
111.8	1	0	0	1	0	0	1	1	0	0	1
111.9	1	0	0	1	0	0	1	1	0	1	1
112.0	1	0	0	1	0	0	1	1	0	1	0
112.1	1	0	0	1	0	0	1	1	1	1	0
112.2	1	0	0	1	0	0	1	1	1	0	0
112.3	1	0	0	1	0	0	1	0	1	0	0
112.4	1	0	0	1	0	0	1	0	1	1	0
112.5	1	0	0	1	0	0	1	0	0	1	0
112.6	1	0	0	1	0	0	1	0	0	1	1
112.7	1	0	0	1	0	0	1	0	0	0	1
112.8	1	0	0	1	0	1	1	0	0	0	1
112.9	1	0	0	1	0	1	1	0	0	1	1
113.0	1	0	0	1	0	1	1	0	0	1	0
113.1	1	0	0	1	0	1	1	0	1	1	0
113.2	1	0	0	1	0	1	1	0	1	0	0
113.3	1	0	0	1	0	1	1	1	1	0	0
113.4	1	0	0	1	0	1	1	1	1	1	0
113.5	1	0	0	1	0	1	1	1	0	1	0
113.6	1	0	0	1	0	1	1	1	0	1	1
113.7	1	0	0	1	0	1	1	1	0	0	1
113.8	1	0	0	1	0	1	0	1	0	0	1
113.9	1	0	0	1	0	1	0	1	0	1	1
114.0	1	0	0	1	0	1	0	1	0	1	0
114.1	1	0	0	1	0	1	0	1	1	1	0
114.2	1	0	0	1	0	1	0	1	1	0	0

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RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
114.3	1	0	0	1	0	1	0	0	1	0	0
114.4	1	0	0	1	0	1	0	0	1	1	0
114.5	1	0	0	1	0	1	0	0	0	1	0
114.6	1	0	0	1	0	1	0	0	0	1	1
114.7	1	0	0	1	0	1	0	0	0	0	1
114.8	1	0	0	1	1	1	0	0	0	0	1
114.9	1	0	0	1	1	1	0	0	0	1	1
115.0	1	0	0	1	1	1	0	0	0	1	0
115.1	1	0	0	1	1	1	0	0	1	1	0
115.2	1	0	0	1	1	1	0	0	1	0	0
115.3	1	0	0	1	1	1	0	1	1	0	0
115.4	1	0	0	1	1	1	0	1	1	1	0
115.5	1	0	0	1	1	1	0	1	0	1	0
115.6	1	0	0	1	1	1	0	1	0	1	1
115.7	1	0	0	1	1	1	0	1	0	0	1
115.8	1	0	0	1	1	1	1	1	0	0	1
115.9	1	0	0	1	1	1	1	1	0	1	1
116.0	1	0	0	1	1	1	1	1	0	1	0
116.1	1	0	0	1	1	1	1	1	1	1	0
116.2	1	0	0	1	1	1	1	1	1	0	0
116.3	1	0	0	1	1	1	1	0	1	0	0
116.4	1	0	0	1	1	1	1	0	1	1	0
116.5	1	0	0	1	1	1	1	0	0	1	0
116.6	1	0	0	1	1	1	1	0	0	1	1
116.7	1	0	0	1	1	1	1	0	0	0	1
116.8	1	0	0	1	1	0	1	0	0	0	1
116.9	1	0	0	1	1	0	1	0	0	1	1
117.0	1	0	0	1	1	0	1	0	0	1	0
117.1	1	0	0	1	1	0	1	0	1	1	0
117.2	1	0	0	1	1	0	1	0	1	0	0
117.3	1	0	0	1	1	0	1	1	1	0	0
117.4	1	0	0	1	1	0	1	1	1	1	0
117.5	1	0	0	1	1	0	1	1	0	1	0
117.6	1	0	0	1	1	0	1	1	0	1	1
117.7	1	0	0	1	1	0	1	1	0	0	1

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
(Sheet 35 of 37)

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
117.8	1	0	0	1	1	0	0	1	0	0	1
117.9	1	0	0	1	1	0	0	1	0	1	1
118.0	1	0	0	1	1	0	0	1	0	1	0
118.1	1	0	0	1	1	0	0	1	1	1	0
118.2	1	0	0	1	1	0	0	1	1	0	0
118.3	1	0	0	1	1	0	0	0	1	0	0
118.4	1	0	0	1	1	0	0	0	1	1	0
118.5	1	0	0	1	1	0	0	0	0	1	0
118.6	1	0	0	1	1	0	0	0	0	1	1
118.7	1	0	0	1	1	0	0	0	0	0	1
118.8	1	0	0	0	1	0	0	0	0	0	1
118.9	1	0	0	0	1	0	0	0	0	1	1
119.0	1	0	0	0	1	0	0	0	0	1	0
119.1	1	0	0	0	1	0	0	0	1	1	0
119.2	1	0	0	0	1	0	0	0	1	0	0
119.3	1	0	0	0	1	0	0	1	1	0	0
119.4	1	0	0	0	1	0	0	1	1	1	0
119.5	1	0	0	0	1	0	0	1	0	1	0
119.6	1	0	0	0	1	0	0	1	0	1	1
119.7	1	0	0	0	1	0	0	1	0	0	1
119.8	1	0	0	0	1	0	1	1	0	0	1
119.9	1	0	0	0	1	0	1	1	0	1	1
120.0	1	0	0	0	1	0	1	1	0	1	0
120.1	1	0	0	0	1	0	1	1	1	1	0
120.2	1	0	0	0	1	0	1	1	1	0	0
120.3	1	0	0	0	1	0	1	0	1	0	0
120.4	1	0	0	0	1	0	1	0	1	1	0
120.5	1	0	0	0	1	0	1	0	0	1	0
120.6	1	0	0	0	1	0	1	0	0	1	1
120.7	1	0	0	0	1	0	1	0	0	0	1
120.8	1	0	0	0	1	1	1	0	0	0	1
120.9	1	0	0	0	1	1	1	0	0	1	1
121.0	1	0	0	0	1	1	1	0	0	1	0
121.1	1	0	0	0	1	1	1	0	1	1	0
121.2	1	0	0	0	1	1	1	0	1	0	0

APPENDIX E: ALTITUDE TRANSMISSION CODE CHART
(Sheet 36 of 37)

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
121.3	1	0	0	0	1	1	1	1	1	0	0
121.4	1	0	0	0	1	1	1	1	1	1	0
121.5	1	0	0	0	1	1	1	1	0	1	0
121.6	1	0	0	0	1	1	1	1	0	1	1
121.7	1	0	0	0	1	1	1	1	0	0	1
121.8	1	0	0	0	1	1	0	1	0	0	1
121.9	1	0	0	0	1	1	0	1	0	1	1
122.0	1	0	0	0	1	1	0	1	0	1	0
122.1	1	0	0	0	1	1	0	1	1	1	0
122.2	1	0	0	0	1	1	0	1	1	0	0
122.3	1	0	0	0	1	1	0	0	1	0	0
122.4	1	0	0	0	1	1	0	0	1	1	0
122.5	1	0	0	0	1	1	0	0	0	1	0
122.6	1	0	0	0	1	1	0	0	0	1	1
122.7	1	0	0	0	1	1	0	0	0	0	1
122.8	1	0	0	0	0	1	0	0	0	0	1
122.9	1	0	0	0	0	1	0	0	0	1	1
123.0	1	0	0	0	0	1	0	0	0	1	0
123.1	1	0	0	0	0	1	0	0	1	1	0
123.2	1	0	0	0	0	1	0	0	1	0	0
123.3	1	0	0	0	0	1	0	1	1	0	0
123.4	1	0	0	0	0	1	0	1	1	1	0
123.5	1	0	0	0	0	1	0	1	0	1	0
123.6	1	0	0	0	0	1	0	1	0	1	1
123.7	1	0	0	0	0	1	0	1	0	0	1
123.8	1	0	0	0	0	1	1	1	0	0	1
123.9	1	0	0	0	0	1	1	1	0	1	1
124.0	1	0	0	0	0	1	1	1	0	1	0
124.1	1	0	0	0	0	1	1	1	1	1	0
124.2	1	0	0	0	0	1	1	1	1	0	0
124.3	1	0	0	0	0	1	1	0	1	0	0
124.4	1	0	0	0	0	1	1	0	1	1	0
124.5	1	0	0	0	0	1	1	0	0	1	0
124.6	1	0	0	0	0	1	1	0	0	1	1
124.7	1	0	0	0	0	1	1	0	0	0	1

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
124.8	1	0	0	0	0	0	1	0	0	0	1
124.9	1	0	0	0	0	0	1	0	0	1	1
125.0	1	0	0	0	0	0	1	0	0	1	0
125.1	1	0	0	0	0	0	1	0	1	1	0
125.2	1	0	0	0	0	0	1	0	1	0	0
125.3	1	0	0	0	0	0	1	1	1	0	0
125.4	1	0	0	0	0	0	1	1	1	1	0
125.5	1	0	0	0	0	0	1	1	0	1	0
125.6	1	0	0	0	0	0	1	1	0	1	1
125.7	1	0	0	0	0	0	1	1	0	0	1
125.8	1	0	0	0	0	0	0	1	0	0	1
125.9	1	0	0	0	0	0	0	1	0	1	1
126.0	1	0	0	0	0	0	0	1	0	1	0
126.1	1	0	0	0	0	0	0	1	1	1	0
126.2	1	0	0	0	0	0	0	1	1	0	0
126.3	1	0	0	0	0	0	0	0	1	0	0
126.4	1	0	0	0	0	0	0	0	1	1	0
126.5	1	0	0	0	0	0	0	0	0	1	0
126.6	1	0	0	0	0	0	0	0	0	1	1
126.7	1	0	0	0	0	0	0	0	0	0	1

APPENDIX F: ABBREVIATIONS

1.	AM	Amplitude Modulation
2.	ANSI	American National Standard Institute
3.	ARINC	Aeronautical Research, Inc.
4.	ARINC 572	Aeronautical Radio Inc Characteristic NR 572-1 "Mark 2 Air Traffic Control Transponder"
5.	ASCII	American National Standard Code for Information Interchange
6.	ATC	Air Traffic Control
7.	ATCRBS	Air Traffic Control Radar Beacon System
8.	ATE	Automatic Test Equipment
9.	BCD	Binary-coded Data
10.	CAL	Calibrate
11.	CR	ASCII Carriage Return
12.	cm	Centimeter
13.	dB	Decibel
14.	dBm	Decibel referred to one milliwatt
15.	DABS	Discrete Address Beacon System
16.	DBL	Double
17.	DCL	Device Clear, GPIB Standard
18.	Δ	Delta
19.	DME	Distance Measuring Equipment
20.	F_1	First Framing Pulse (XPDR)
21.	F_2	Second Framing Pulse (XPDR)
22.	ft/sec	Feet per second
23.	ft/sec^2	Feet per second squared

24.	Fhi	Frequency High
25.	Flo	Frequency Low
26.	GET	Group Execute Trigger
27.	GPIB	General Purpose Interface Bus
28.	GTL	Go To Local, GPIB Standard
29.	>	Greater
30.	Hz	Hertz
31.	kHz	Kilohertz
32.	kΩ	Kilohm
33.	KTS	Knots
34.	LLO	Local Lockout, GPIB Standard
35.	LF	Line feed
36.	MHz	Megahertz
37.	MLA	My Listen Address, GPIB Standard
38.	MTA	My Talk Address, GPIB Standard
39.	MTL	Minimum Threshold Level
40.	µs	Microsecond
41.	ns	Nanosecond
42.	nmi	Nautical mile
43.	Ω	Ohm
44.	P_1	First Interrogation Pulse (DME)
45.	P_2	Second Interrogation Pulse (DME)
46.	pk	Peak
47.	PP/S	Pulse pairs per second
48.	PRF	Pulse Repetition Frequency

49.	%	Percent
50.	RF	Radio Frequency
51.	RMS	Root-Mean-Square
52.	SLS	Side Lobe Suppression
53.	SPI	Special Position Identification Pulse
54.	TACAN	Tactical Air Navigation
55.	TTL	Transistor-Transistor Logic
56.	UNL	Unlisten, GPIB Standard
57.	UNT	Untalk, GPIB Standard
58.	UUT	Unit under test
59.	V	Volt
60.	VAC	Volt Alternating Current
61.	VOR	Very High Frequency OMNI Directional Radio Range
62.	VSWR	Voltage Standing-Wave Ratio
63.	XMTR	Transmitter
64.	XPDR	Transponder

APPENDIX G: TABLE OF USER I/O PORTS/CONNECTOR PIN-OUT TABLES

G-1 TABLE OF I/O PORTS

REFERENCE DESIGNATOR	CONNECTOR NAME	CONNECTOR TYPE	SIGNAL INPUT/OUTPUT	SIGNAL TYPE
J1	DABS	SMB		*
J2	TACAN	SMB		*
J3	30 MHz IF	SMB		*
J4	Not Used	SMB		*
J5	IFR BUS	25 Pin, Type D	Input/Output	See Pin out *
J6	AUXILIARY	25 Pin, Type D	Input/Output	See Pin out *
J7	INDICATOR	25 Pin, Type D	Input/Output	See Pin out
J8	Interrogator	25 Pin, Type D	Input/Output	See Pin out
J9	R/NAV	BNC	Output	ARINC Digital
J10	GEN	BNC	Output	TTL or 50 Ohms
J11	XMTR	BNC	Output	TTL or 50 Ohms
J12	Primary Power	Switchcraft EAC-301	Input	95/230 VAC
J13	Indicator Power	AMPHENOL 6702E1260P	Input	115 VAC 400 Hz
J14	GPIB Interface	IEEE Standard	Input/Output	IEEE Standard
J15	RF	Type N	Input/Output	50 Ohms
J16	XMTR	BNC	Output	50 Ohms
J17	GEN	BNC	Output	50 Ohms
J18	SUPPRESSOR	BNC	Output	30 Volt/Variable
J19	CAL MARKS	BNC	Output	TTL or 50 Ohms
J20	SYNC	BNC	Output	TTL or 50 Ohms
J21	DISCRIMINATOR	BNC	Output	50 Ohms
J22	EXTERNAL PULSE	BNC	Input	Active Low TTL

* Intended for use with IFR constructed accessory equipment only.

G-2 PIN OUT TABLE FOR IFR BUS CONNECTOR J5 (68)

The table below provides pin assignments for the IFR BUS Connector J5 (68) located on the rear panel of the ATC-1400. This connector provides power and signal sources for IFR constructed accessory equipment.

J5 IFR BUS CONNECTOR PIN ASSIGNMENTS

Pin No.	Signal Name	Signal Type	Input/Output	Polarity
1	Gnd			
2	AØ	TTL	Output	Positive
3	A1	TTL	Output	Positive
4	Gnd			
5	A2	TTL	Output	Positive
6	D7	TTL	Input/Output	Positive
7	Gnd			
8	A3	TTL	Output	Positive
9	D6	TTL	Input/Output	Positive
10	Gnd			
11	A4	TTL	Output	Positive
12	D5	TTL	Input/Output	Positive
13	Gnd			
14	A5	TTL	Output	Positive
15	D4	TTL	Input/Output	Positive
16	Gnd			
17	REEN	TTL	Output	Positive Strobe
18	D3	TTL	Input/Output	Positive
19	Gnd			
20	WREN	TTL	Output	Positive Strobe
21	D2	TTL	Input/Output	Positive
22	INT	Open Collector	Input	Active Low
23	INTR	Open Collector	Output	Active Low
24	D1	TTL	Input/Output	Positive
25	DØ	TTL	Input/Output	Positive

G-3 PIN OUT TABLE FOR AUXILIARY CONNECTOR J6 (69)

The table below provides pin assignments for the AUXILIARY Connector J6 (69) located on the rear panel of the ATC-1400. This connector provides power and signal sources for IFR constructed accessory equipment.

	J6 AUXILIARY CONNECTOR PIN ASSIGNMENT			
Pin No.	Signal Name	Signal Type	Input/Output	Polarity
1	Gnd			
2	X/$\overline{Y}$	TTL	Output	
3	Serial Data	Tri-State	Input/Output	Positive
4	Serial Sync	Tri-State	Input/Output	Positive
5	$\overline{\text{External Pulse}}$	TTL	Input	Active Low
6	$\overline{\text{External SLS}}$	TTL	Input	Active Low
7	$\overline{\text{External Priority}}$	TTL	Input	Active Low
8	Pulse	TTL	Output	Positive
9	20 MHz	TTL	Output	Rising Edge
10	Decode	TTL	Output	Rising Edge
11	50% Video	TTL	Output	Positive
12	N/C			
13	N/C			
14	15 Hz	Tri-State	Input/Output	Rising Edge
15	Gnd			
16	Serial Clock	Tri-State	Input/Output	Rising Edge
17	Gnd			
18	Gnd			
19	Gnd			
20	Gnd			
21	Gnd			
22	Gnd			
23	Gnd			
24	Gnd			
25	TACAN ENABLE	TTL	Input	Active Low

G-4 PIN OUT TABLE FOR INDICATOR CONNECTOR J7 (67)

The table below provides pin assignments for the INDICATOR Connector J7 (67) located on the rear panel of the ATC-1400. This connector provides power and signal sources to the DME Indicator under test.

J7 INDICATOR CONNECTOR PIN ASSIGNMENTS

Pin No.	Signal Name	Signal Type	Input/Output	ARINC 568 Indicator Pin No.
1	Serial Data Hi	ARINC Digital	Output	B
2	Serial Data Low	Gnd		C
3	Serial Clock Hi	ARINC Digital	Output	T
4	Serial Clock Low	Gnd		U
5	Serial Sync Hi	ARINC Digital	Output	S
6	Serial Sync Low	Gnd		a
7	N/C			A
8	Analog Distance Hi	ARINC Digital	Output	L
9	Analog Distance Low	Gnd		M
10	Range Rate Hi	ARINC Digital	Output	Y
11	Range Rate Low	Gnd		Z
12	Shield Gnd	Chassis Gnd		K
13	26 VAC 400 Hz	Hot Power	Output	W
14	AC Common	Return Power	Output	X
15	Warning Flag	30 V/Variable	Output	b
16	Chassis Gnd	Chassis Gnd		c
17	5V Instrument Light Dim	+5V/Open	Output	d
18	Return Instrument Light	Gnd		v
19	N/C			
20	N/C			
21	N/C			
22	N/C			
23	N/C			
24	N/C			
25	N/C			

NOTE:

Analog Distance Hi pulse (pin 8) is identical to the R/NAV pulse output at connector J9. (See Item 62, Page 3-17.)

G-5 PIN OUT TABLE FOR INTERROGATOR CONNECTOR J8 (66)

The table below provides pin assignments for the INTERROGATOR Connector J8 (66) located on the rear panel of the ATC-1400. This connector provides power and signal sources to the DME Interrogator under test.

J8 INTERROGATOR CONNECTOR PIN ASSIGNMENTS

Pin No.	Signal Name	Signal Type	Input/Output	ARINC 568 Interrogator Pin No.
1	Tens A	Open Collector	Output	BP 33
2	Tens B	Open Collector	Output	BP 34
3	Units A	Open Collector	Output	BP 35
4	Units B	Open Collector	Output	BP 36
5	Units C	Open Collector	Output	BP 37
6	Units D	Open Collector	Output	BP 38
7	Units E	Open Collector	Output	BP 39
8	Tenths A	Open Collector	Output	BP 20
9	Tenths B	Open Collector	Output	BP 21
10	Tenths C	Open Collector	Output	BP 22
11	Tenths D	Open Collector	Output	BP 23
12	Tenths E	Open Collector	Output	BP 24
13	Hundredths C	Open Collector	Output	BP 25
14	Frequency Common	Gnd	Output	BP 26
15	N/C			
16	N/C			
17	N/C			
18	Chassis Gnd	Chassis Gnd		
19	Chassis Gnd	Chassis Gnd		
20	Serial Data Hi	ARINC Digital	Input	BP 58
21	Serial Data Low	Gnd	Input	BP 59
22	Serial Clock Hi	ARINC Digital	Input	BP 45
23	Serial Clock Low	Gnd	Input	BP 46
24	Serial Sync Hi	ARINC Digital	Input	BP 48
25	Serial Sync Low	Gnd	Input	BP 60

APPENDIX H: REPACKING FOR SHIPMENT

H-1 SHIPPING INFORMATION

IFR test sets returned to factory for calibration, service or repair must be repackaged and shipped subject to the following conditions:

- Do not return any products to factory without first receiving authorization from IFR Customer Service Department.

  CONTACT: Customer Service Department
  IFR, Inc.
  10200 West York Street
  Wichita, Kansas 67215

  Telephone: (800) 835-2350
  TWX: 910-741-6952

- All test sets must be tagged with:

  a. Owner's identification and address
  b. Nature of service or repair required
  c. Model number
  d. Serial number

- Sets must be repackaged in original shipping containers using IFR packing molds. If original shipping containers and materials are not available, contact IFR Customer Service Department for shipping instructions.

- All freight costs on non-warranty shipments are assumed by customer. (See "Warranty Packet" for freight charge policy on warranty claims.)

H-2 REPACKING PROCEDURE (Reference - Figure H-1):

1. Make sure bottom packing mold is seated on floor of shipping container.

2. Carefully wrap test set for polyethylene sheeting to protect finish.

3. Place test set into shipping container, making sure set is securely seated in bottom packing mold.

4. Place top packing mold over top of set and press down until mold rests solidly on bottom packing mold.

5. Close shipping container lids and seal with shipping tape or an industrial stapler. Tie all sides of container with break-resistant rope, twine, or equivalent.

REPACKING FOR SHIPMENT

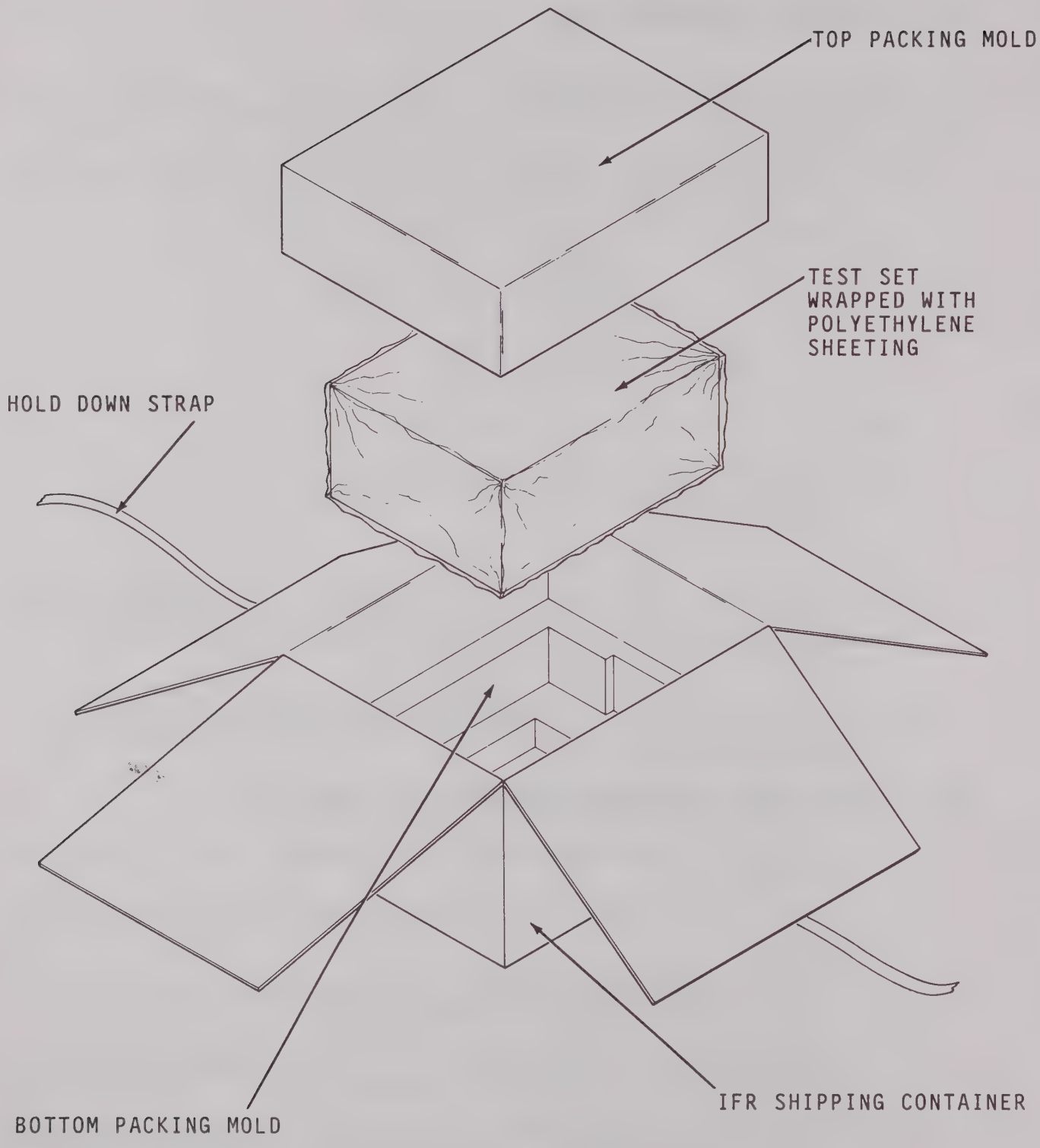


Figure H-1

APPENDIX I: BASELINE SETTING USING ATC-1400 XMTR DETECTED OUTPUT

I-1: BASELINE SETTING:

The detector is non-linear below 3 watts and is offset from zero by a voltage equivalent to about 1.5 watts at the RF input. When measuring the 10%, 50% and 90% points using the XMTR output, it is necessary to offset the baseline on the oscilloscope by 50 millivolts when operating into a 50 Ohm load. Use the oscilloscope ground reference to set the true baseline at 0 volts.

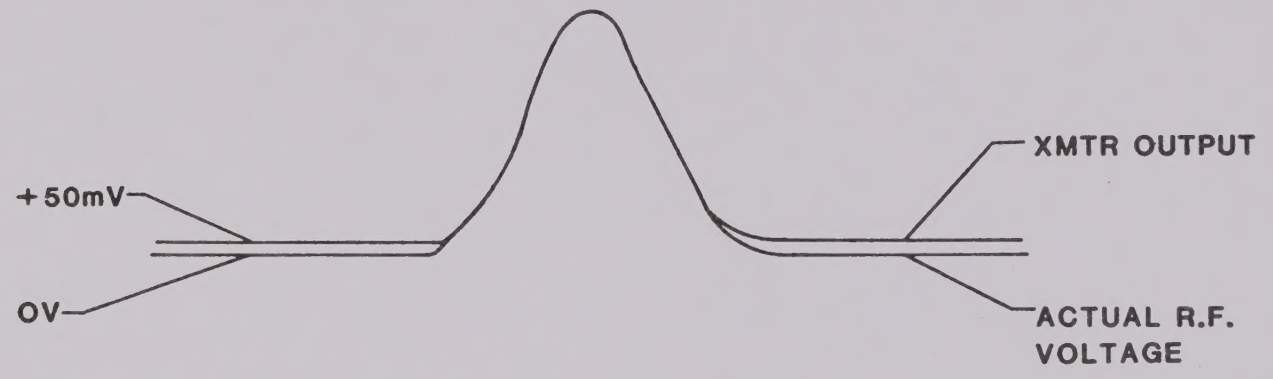


Figure I-1 Typical XMTR Display For 50 Watt Transmitter

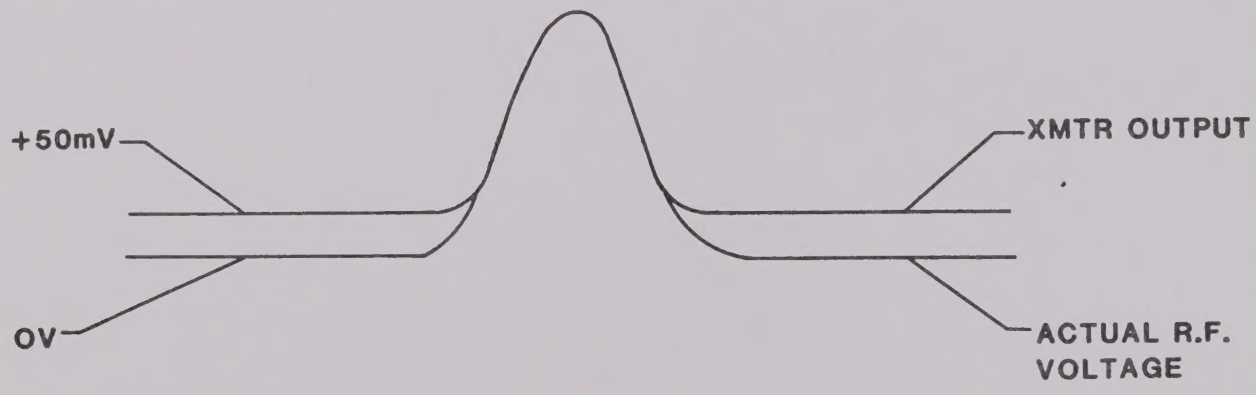
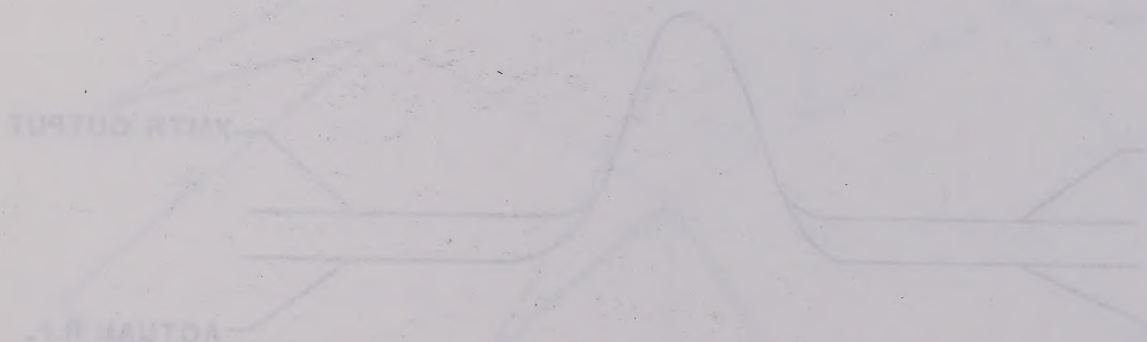


Figure I-2 Typical XMTR Display For 500 Watt Transmitter

When operating into an open load the actual baseline is not at 0 Volts. The actual baseline is 100 millivolts below the indicated baseline.

XMTR OUTPUT
+50mV
0V
ACTUAL R.F.
VOLTAGE


XMTR OUTPUT
+50mV
0V
ACTUAL R.F.
VOLTAGE

www.manualsplus.com
1013652